Supporting Documents

1.1.3 & 1.2.1

Electronics & Communication Engineering

S. No.	Documents attached
1	Syllabus of Courses Highlighting the Focus on Employability/ Entrepreneurship/ Skill Development

SCHEME & SYLLABUS OF B. Tech. 1st& 2nd SEMESTER

(Common to all B. Tech. Disciplines)

Batch-2011

By

Department of Academics

PUNJAB TECHNICALUNIVERSITY

Head
Department of Electronics & Communication Engineering
IK Gujral Punjab Technical University
Main Campus, Kapurthala (Punjab)-144603

Physics Group **B. Tech. First Semester** **Contact Hours: 32 Hrs.**

Course Code	Course Name	Load Allocation L	T	P	Marks Distribution Internal	External	Total	Credits
BTPH101	Engineering Physics	3	1	-	40	60	100	4
BTAM101	Engineering Mathematics-I	4	1	-	40	60	100	5
BTHU101	Communicative English	3	0	-	40	60	100	3
BTEE 101	Basic Electrical and Electronics Engineering	4	1	-	40	60	100	5
HVPE101	Human Values and Professional Ethics	3	-	-	40	60	100	3
BTPH102	Engineering Physics Laboratory	-	-	2	30	20	50	1
BTHU102	Communicative English Laboratory	-	-	2	30	20	50	1
BTEE102	Basic Electrical and Electronics Engineering Laboratory	-	-	2	30	20	50	1
BTMP101	Manufacturing Practice	-	-	6	60	40	100	3
Total	5Theory Courses + 4 Laboratory Courses	17	3	12	350	400	750	26

Chemistry Group **B. Tech. First Semester** **Contact Hours: 34 Hrs**

Course Code	Course Name	Load Allocation L	T	P	Marks Distribution Internal	External	Total	Credits
BTCH 101	Engineering Chemistry	3	1	-	40	60	100	4
BTAM101	Engineering Mathematics-I	4	1	-	40	60	100	5
BTME101	Elements of Mechanical Engineering	4	1	-	40	60	100	5
BTCS 101	Fundamentals of Computer Programming and IT	3	-	-	40	60	100	3
EVSC 101	Environmental Science	2	0	-	40	60	100	2
BTCH102	Engineering Chemistry Laboratory	-	-	2	30	20	50	1
BTME102	Engineering Drawing	1	-	6	40	60	100	4
BTCS 102	Fundamentals of Computer Programming and IT Laboratory	-	-	4	30	20	50	2
BTME103	Engineering Computer Graphics Laboratory	-	-	2	30	20	50	1
Total	6Theory Courses + 3 Laboratory Courses	17	3	14	330	420	750	27

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Physics Group **B. Tech. Second Semester** **Contact Hours: 32 Hrs.**

Course Code	Course Name	Load Allocation L	T	P	Marks Distribution Internal	External	Total	Credits
BTPH101	Engineering Physics	3	1	-	40	60	100	4
BTAM102	Engineering Mathematics-II	4	1	-	40	60	100	5
BTHU101	Communicative English	3	0	-	40	60	100	3
BTEE 101	Basic Electrical and Electronics Engineering	4	1	-	40	60	100	5
HVPE101	Human Values and Professional Ethics	3	-	-	40	60	100	3
BTPH102	Engineering Physics Laboratory	-	-	2	30	20	50	1
BTHU102	Communicative English Laboratory	-	-	2	30	20	50	1
BTEE102	Basic Electrical and Electronics Engineering Laboratory	-	-	2	30	20	50	1
BTMP101	Manufacturing Practice	-	-	6	60	40	100	3
Total	5Theory Courses + 4 Laboratory Courses	17	3	12	350	400	750	26

Chemistry Group **B. Tech. Second Semester** **Contact Hours: 34 Hrs.**

Course Code	Course Name	Load Allocation L	T	P	Marks Distribution Internal	External	Total	Credits
BTCH 101	Engineering Chemistry	3	1	-	40	60	100	4
BTAM102	Engineering Mathematics-II	4	1	-	40	60	100	5
BTME101	Elements of Mechanical Engineering	4	1	-	40	60	100	5
BTCS 101	Fundamentals of Computer Programming and IT	3	-	-	40	60	100	3
EVSC 101	Environmental Science	2	0	-	40	60	100	2
BTCH102	Engineering Chemistry Laboratory	-	-	2	30	20	50	1
BTME102	Engineering Drawing	1	-	6	40	60	100	4
BTCS 102	Fundamentals of Computer Programming and IT Laboratory	-	-	4	30	20	50	2
BTME103	Engineering Computer Graphics Laboratory	-	-	2	30	20	50	1
Total	6Theory Courses + 3 Laboratory Courses	17	3	14	330	420	750	27

First Semester + Second Semester + General Fitness= 750 +750+100= 1600 Marks

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BTPH 101 Engineering Physics

Objective/s and Expected outcome:

The objective of the course is to develop a scientific temper and analytical capability in the engineering graduates through the learning of physical concepts and their application in engineering & technology. Comprehension of some basic physical concepts will enable graduates to think logically the engineering problems that would come across due to rapidly developing new technologies. The student will be able to understand the various concepts effectively; logically explain the physical concepts; apply the concept in solving the engineering problem; realize, understand and explain scientifically the new developments and breakthroughs in engineering and technology; relate the developments on Industrial front to the respective physical activity, happening or phenomenon.

PART A

1. **EM waves & Dielectrics:** Physical significance of Gradient, Divergence & Curl, Relationship between Electric Field & Potential, Dielectric polarization, displacement Current, Types of polarization, Maxwell"s Equations, Equation of EM waves in free space, velocity of EM waves, Poynting vector, Electromagnetic Spectrum (Basic ideas of different region). **(5)**
2. **Magnetic Materials & Superconductivity:** Basic ideas of Dia, Para, Ferro & Ferri, Ferrites, Magnetic Anisotropy, Magnetostriction its applications in production of Ultrasonic waves, Superconductivity, Superconductors as ideal diamagnetic materials, Signatures of Superconducting state, Meissner Effect, Type I & Type II superconductors, London Equations, Introduction to BCS theory. **(5)**
3. **Elements of crystallography:** Unit cell, Basis, Space lattice, Crystal Systems, Miller Indices of Planes & Directions in cubic system, Continuous & Characteristic X-Rays, X-Ray Diffraction & Bragg"s law in Crystals, Bragg"s spectrometer, X-ray radiography. **(5)**
4. **Lasers:** Spontaneous & Stimulated emissions, Einstein"s Coefficients, Population Inversion, Pumping Mechanisms, Components of a laser System, Three & four level laser systems; Ruby, He-Ne, CO_2 and semiconductor Lasers, Introduction to Holography. **(5)**

PART B

5. **Fibre Optics:** Introduction, Acceptance Angle, Numerical Aperture, Normalized frequency, Modes of propagation, material dispersion & pulse broadening in optical fibres, fibre connectors, splices and couplers, applications of optical fibres. **(5)**

6. **Special Theory of Relativity:** Concept of Ether, Michelson Morley Experiment, Einstein"s postulates, Lorentz transformation equations; length, time and simultaneity in relativity, addition of velocity, variation of mass with velocity, Mass-Energy and Energy-momentum relations. **(5)**

7. **Quantum Theory:** Need and origin of quantum concept, Wave-particle duality, Matter waves, Group & Phase velocities, Uncertainty Principle, Significance & normalization of wave function, Schrodinger wave equation: time independent & dependent, Eigen functions & Eigen values, particle in a box. **(5)**

8. **Nanophysics:** Nanoscale, surface to volume ratio, electron confinement, nanoparticles (1D, 2D, 3D), Nanomaterials, Unusual properties of nanomaterials, synthesis of nanomaterials- ball milling and sol-gel techniques, Carbon nanotubes (synthesis and properties), applications of nanomaterials. **(5)**

Suggested Readings / Books:

1. Physics for Scientists & Engineers (Vol. I & II), Serway & Jewett, 6th Edition., Cengage Learning.
2. Engineering Physics, Malik; HK, Singh; AK, Tata McGraw Hill,
3. Materials Science & Engg., Raghvan V.,Prentice Hall of India.
4. Concepts of Modern Physics, Beiser; A., Mahajan; S., Choudhary; SR, Tata McGraw Hill.
5. Solid State Physics, Dan Wei, Cengage Learning.
6. Introduction to Solids, Azaroff LV, Tata Mc Graw Hill.
7. Physics; A calculus based approach (Vol. I & II) Serway; RA & Jewitt; JW, Cengage Learning.Materials Science & Engineering, Callister; WD, John Wiley & Sons.
8. Introduction to Electrodynamics, Griffiths; DJ, Prentice Hall.
9. Lasers & Optical engineering, Dass; P, Narosa Publishers.
10. Optical Fibre system, Technology, Design & Applications, Kao; CK, McGraw Hill.
11. Laser Theory & Applications, Thygrajan; K, Ghatak; AK, Mc Millan India Ltd.

BTAM 101Engineering Mathematics-I

Objective/s and Expected outcome

"Math and basic science are certainly the foundations of any engineering program. This fact will not change in the foreseeable future" said by Ellis et al. Engineering Mathematics is an essential tool for describing and analyzing engineering processes and systems. Mathematics also enables precise representation and communication of knowledge. Core mathematics courses have broader objectives than just supporting engineering programs. The learning objectives of core mathematics courses can be put into three categories: (1) Content Objectives: Students should learn fundamental mathematical concepts and how to apply them. (2) Skill Objectives: Students should learn critical thinking, modeling/problem solving and effective uses of technology. (3) Communication Objectives: Students should learn how to read mathematics and use it to communicate knowledge. The students are expected to understand the fundamentals of the mathematics to apply while designing technology and creating innovations.

PART A

1. **Differential Calculus:** Curve tracing: Tracing of Standard Cartesian; Parametric and Polar curves; Curvature of Cartesian, Parametric and Polar curves. **(6)**
2. **Integral Calculus:** Rectification of standard curves; Areas bounded by standard curves; Volumes and surfaces of revolution of curves; Applications of integral calculus to find centre of gravity and moment of inertia. **(6)**
3. **Partial Derivatives:** Function of two or more variables; Partial differentiation; Homogeneous functions and Euler"s theorem; Composite functions; Total derivative; Derivative of an implicit function; Change of variable; Jacobians. **(6)**
4. **Applications of Partial Differentiation:** Tangent and normal to a surface; Taylor"s and Maclaurin"s series for a function of two variables; Errors and approximations; Maxima and minima of function of several variables; Lagrange"s method of undetermined multipliers. **(6)**

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PART B

5. **Multiple Integrals:** A brief introduction of cylinder, cone and standard conicoids. Double and triple integral and their evaluation, change of order of integration, change of variable, Application of double and triple integration to find areas and volumes. **(6)**

6. **Vector Calculus:** Scalar and vector fields, differentiation of vectors, velocity and acceleration. Vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Formulae involving Del applied to point functions and their products. Line, surface and volume integrals. **(8)**

7. **Application of Vector Calculus:** Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem. Green"s theorem in plane, Stoke"s theorem (without proofs) and their applications. **(4)**

Suggested Readings / Books

1. Thomes, G.B, Finney, R.L. Calculus and Analytic Gemetry, Ninth Edition, Peason Education.
2. Kreyszig, E., Advanced Engineering Mathematics, Eighth edition, John wiley.
3. Peter. V. O" Nil, Advanced Engineering Mathematics, Wordsworth Publishing Company.
4. Jain, R.K and Lyengar, S.R.K., Advanced Engineering Mathematics, Narosa Publishing Company.
5. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
6. Taneja, H.C., Engineering Mathematics, Volume-I & Volume-II, I.K. Publisher.
7. Babu Ram, Advance engineering Mathematics, Pearson Education.
8. Bindra,. J.S., Applied Mathematics, Volume-I, Kataria Publications.

BTHU 101 Communicative English

Objective/s and Expected outcome:

The objective is to help the students to become independent users of english language. Students should be able to understand spoken and written english language of varied complexity on most including some abstract topics; particularly the language of their chosen technical field. They must show awareness of appropriate format and a capacity for explaining their views in a rational manner. The students should be able to converse fluently, without strain with international speakers of english in an accent and lexis that is widely understood across the globe. They will be able to produce on their own texts which are clear and coherent.

1. **Reading:** Reading texts of varied complexity; speed reading for global and detailed meaning; processing factual and implied meanings
2. **Vocabulary:** Building up and expansion of vocabulary; active use of the prescribed expressions in the appropriate context
3. **Grammar**: Revising and practicing a prescribed set of grammar items; using grammar actively while processing or producing language
4. **Writing:** The qualities of good writing; Learning the prescribed written expressions of conventional use; writing business letters, emails; reports, summaries and various forms of descriptive and argumentative essays

Learning and Teaching Activities:

PART A (Reading)

The prescribed reading textbook for students will be S. P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD), Orient Blackswan. They will go through the reading texts themselves with the help of a dictionary or word power as given at the end. As they progress from one reading to another they should learn to read fast with greater degree of understanding of both concrete and abstract topics. While taking up the textbook lessons in the classroom, the teacher shall ensure that students can do the following:

i. Identify the significant points and conclusions as given in the text.
ii. Handle large texts (even outside the prescribed book) with overall comprehension of the links between arguments and the finer distinction between stated and implied meanings.
iii. Generally read the stance or the point of view of the writer and present it in the form of a summary

iv. Use the vocabulary learnt in the lessons (especially given in „word power") productively in various writing tasks as suggested at the end of each lesson.

v. Profitably use the grammatical items as discussed at the end of each lesson while producing language for communication.

Besides the textbook, the teacher must insist that students extend their reading by taking up additional texts of their own choice.

PART B (Writing)

In addition to the various exercises given at the end of each lesson of Dhanavel"s book, the teacher shall use Anne Laws Writing Skills, Orient Blackswan to teach the language and conventions of writing. The students must learn the language that expresses various cognitive functions that are frequently used in writing. With the help of the teacher who will give them adequate practice, the students should be able to:

i.Convey information on concrete or abstract topics with clarity and precision.

ii. Write about objects or events with appropriate detail in both descriptive and narrative form.

iii. Explain ideas and build up arguments with adequate support in a convincing manner.

iv. Use language with some degree of flexibility in consideration to the reader.

v.Produce effectively such forms of professional writing as business letter, emails, notes, memos, reports summaries etc.

While teaching, the teacher must inculcate in students the habit of revising their writing. The teacher can also use and recommend the relevant sections of the following books for developing writing skills in students.

Suggested Readings/ Books

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi

2. KK Ramchandran, et al Business Communication, Macmillan, New Delhi

3. Swati Samantaray, Busines Commnication and Commnicative English, Sultan Chand, New Delhi.

4. S.P. DhanavelEnglish and Communication Skills for Students of Science and Engineering (with audio CD)

BTEE 101 Basic Electrical and Electronics Engineering

Objective/s and Expected outcome:

This course is mandatory for all the branches for understanding the basic concepts of Electrical and Electronics Engineering. Students of all branches have to deal with the applications of Electrical Engineering and Electronics Engineering. This course gives a basic knowledge of circuits, transducers, semiconductor devices with which a building of innovative technology can be created. The students are expected to learn and understand the importance and applications of electric and electronics material. This knowledge give them a brief outline of the fundamentals that would be the foundations of todays" and tomorrow"s technology.

Part A (Electrical Engineering)

1. Direct Current (DC) Circuits:

Circuit elements and connected terminology, Kirchoff"s Laws- Statement and Illustrations, Method of solving circuits by Kirchoff"s law, Star-Delta Conversion, Computation of resistance at constant temperature, resistance at different temperatures, Ohm"s Law- Statement, Illustration and Limitation, Units- Work, Power and Energy (Electrical, Thermal and Mechanical). DC Transients for RL and RC series circuits **(7)**

2. Alternating Current (AC) Fundamentals:

Generation of alternating electro-motive force EMF, Concept of 3-phase EMF Generation, Peak, Root Mean Square and Average value of alternating current, Phasor representation of alternating quantities, Analysis of AC Circuit Representation of Alternating Quantities in Rectangular and polar forms. Introduction of Resistive, Inductive & Capacitive circuits and their series and parallel combinations. Concept of resonance in series and parallel circuits, Analysis of balanced 03 phase system with star-delta connections. **(7)**

3. Magnetic Circuits and Transformer:

Comparison between magnetic and electric circuits, Magnetic effects of electric current, Current carrying conductor in magnetic field, Law of Electromagnetic Induction and its law, Self Inductance, Mutual Inductance, Coupling Coefficient between two magnetically coupled circuits. Single Phase Transformer: Construction, Working principle, Efficiency, Voltage regulation and applications. **(7)**

4. Rotating Electrical Machines:

D.C. machines (motors and generators), Three phase Induction motor, Synchronous machines (motors and generators): construction, working principle, classification and applications. **(7)**

Part B (Electronics Engineering)

5. Transducers:

Introduction, working and application of LVDT, Strain Gauge and Thermistor. Introduction and application of Digital Multimeter. (7)

6. Semiconductor Devices:

Principle of operation characteristic and application of PN Junction Diode, Rectifiers, Zener Diode, Principle of operation characteristic and application of Bipolar Junction Transistor, Principle of operation and characteristic Field Effect Transistor, Regulated Power Supply. **(7)**

7. Digital Electronics:

Binary, Octal and Hexadecimal number System & its arithmetic operations, Logic gates, Introduction of R-S, J-K, D and T Flip Flops & its truth tables. **(6)**

Suggested Readings/ Books

1. Basic Electrical and Electronics and Computer Engineering by R Muthusubramanian, S Salivahanan,K A Muraleedharan, Tata McgrawHill
2. A Textbook of Electrical Techology by B.L Theraja.& A.K Theraja, S Chand publishers.
3. Electrical Technology, Edward Hughes, Addisin Wesley Longman Limited.
4. A Course in electrical and electronic Measurements & Instumentation by A.K Sawhney, Dhanpat Rai & Co.

EVSC 101 Environmental Science

Objective/s and Expected outcome:

Upon successful completion of the course, students should be able to:

1. Measure environmental variables and interpret results
2. Evaluate local, regional and global environmental topics related to resource use and management
3. Propose solutions to environmental problems related to resource use and management
4. Interpret the results of scientific studies of environmental problems
5. Describe threats to global biodiversity, their implications and potential solutions

Part A

1. **Introduction:** Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness. (2)
2. **Natural Resources:** Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources. (4)
3. **Ecosystems:** Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity (4)
4. **Environmental Pollution:** Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management : Floods, earthquake, cyclone and landslides. (5)

PART B

5. Social Issues and the Environment From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention

and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness **(5)**

6. Human Population and the Environment, Population growth, variation among nations. Population explosion - Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child W elfare. Role of Information Technology in Environment and human health. Case studies **(4)**

Suggested Readings / Books

1. Agarwal, K. C. 2001 Environment Biology, Nidi Publ. Ltd. Bikaner.
2. Jadhav, H & Bhosale, V.M. 1995. Environment Protection and Laws. Himalaya Pub House, Delhi 284p.
3. Rao M. N. & Datta A.K. 1987. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
4. Principle of Environment Science by Cunninghan, W.P.
5. Essentials of Environment Science by Joseph.
6. Environment Pollution Control Engineering by Rao, C.S.
7. Perspectives in Environmental Studies by Kaushik, A.
8. Elements of Environment Science & Engineering by Meenakshi.
9. Elements of Environment Engineering by Duggal.

BTPH 102 Engineering Physics Laboratory

1. To study the magnetic field of a circular coil carrying current.

2. To find out polarizability of a dielectric substance.

3. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.

4. To study laser interference using Michelson"s Interferometer.

5. Study of diffraction using laser beam and thus to determine the grating element.

6. To determine numerical aperture of an optical fibre.

7. To determine attenuation & propagation losses in optical fibres.

8. To find out the frequency of AC mains using electric-vibrator.

9. To find the refractive index of a material using spectrometer.

10. To find the refractive index of a liquid.

11. To study B-H curve using CRO.

12. To find the velocity of ultrasound in liquid.

13. To determine the grain size of a material using optical microscope.

Note: Each student is required to perform at least ten experiments

Suggested Readings / Books

1. Practical Physics, C.L. Arora, S. Chand & Co.
2. Practical Physics, R.S. Sirohi, Wiley Eastern.

BTHU 102 Communication Skills Laboratory

Lab Exercises

Listening and Speaking

The audio CD accompanying S.P. Dhanavel"s book shall be played in the lab to get the students familiar with the standard spoken English. The students must develop a high degree of understanding of spoken material as used in academic and professional environment. The teacher shall help them in the following:

a) With the accent of the speaker if it is unfamiliar to them.

b) The Standard English sounds and pronunciation of words.

c) With the topical vocabulary and the idiomatic expressions which are generally part of colloquial speech.

d) With the implied relationships in larger texts, if they are not stated explicitly.

In addition to the above, extended listening sessions shall be arranged to promote speaking activities among students. For this purpose, a set of twin books ***K. Sadanand and S. Punitha Spoken English Part I and II, A Foundation Course (with audio CD), Orient Blackswan,*** is prescribed for use. The teachers shall play the CDs selectively in the lab and involve the students in the practice work based on them. While taking up lessons, the teacher must promote the use of dictionaries for correct pronunciation and give ample practice on word stress and weak forms.

The students are also supposed to supplement their listening practice by regularly viewing news/knowledge channels on the TV or lecture videos on the internet.

At the end of a session, a good speaker must:

a) Be able to produce long turns without much hesitation in an accent that is understood all around.

b)Have ready access to a large lexis and conventional expressions to speak fluently on a variety of topics.

c) Have a knack for structured conversation or talk to make his transitions clear and natural to his listeners.

The teacher may use following different classroom techniques to give practice and monitor the progress of the students:

- role play
- question-answer
- discussion
- presentation of papers
- seminars

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BTEE 102 Basic Electrical and Electronics Engineering Laboratory

List of Experiments to be performed

1. To verify Ohm"s Law and its limitations.
2. To verify Kirchoff"s Laws.
3. To measure the resistance and inductance of a coil by ammeter-voltmeter method.
4. To find voltage-current relationship in a R-L series circuit and to determine the power factor of the circuit.
5. To verify the voltage and current relations in star and delta connected systems.
6. To measure power and power factor in a single- phase AC circuit.
7. To verify series and parallel resonance in AC circuits.
8. To observe the B-H loop of ferromagnetic core material on CRO.
9. To use a bridge rectifier for full- wave rectification of AC supply and to determine the relationship between RMS and average values of the rectified voltage.
10. To measure the minimum operating voltage, current drawn, power consumed, and the power factor of a fluorescent tube light.
11. To verify the working of a). Thermocouple b). Strain Gauge c). LVDT.
12. To verify the rating of compact fluorescent lamp (CFL).
13. To obtain the characteristics of a P-N junction diode.
14. To verify the truth table of logic gates.
15. To connect the following ,measuring instruments to measure current, voltage and power in AC/DC circuits:
    - i. Moving Coil Instruments
    - ii. Moving Iron Instruments
    - iii. Dynamometer Instruments
    - iv. Multimeter- both Digital and Analog Type
16. To obtain the characteristics of a transistor under common base (CB) and common emitter (CE) configuration.
17. To perform open- and short circuit tests on a single phase transformer and calculate its efficiency
18. To start and reverse the direction of rotation of a
    - i. DC motor
    - ii. Induction motor

Note: Each student is required to perform at least ten experiments

Suggested Readings / Books

1. S.K. Bhattacharya and R.K. Rastogi, Experiments in Electrical Engineering, New Age International Publishers Ltd., New Delhi.
2. D.R. Kohli and S.K. Jain, Experiments in Electrical Machines.

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BTMP 101 Manufacturing Practice

PART A

1. **Carpentry and Pattern Making:** Various types of timber and practice boards, defects in timber, seasoning of wood; tools, wood operation and various joints; exercises involving use of important carpentry tools to practice various operations and making joints.
2. **Foundry Shop:** Introduction to molding materials; moulds; use of cores; melting furnaces; tools and equipment used in foundry shops; firing of a cupola furnace; exercises involving preparation of small sand moulds and castings.
3. **Forging Practice:** Introduction to forging tools; equipments and operations; forgability of metals; exercises on simple smithy; forging exercises.
4. **Machine Shop:** Machines, Grinders etc; cutting tools and operations; exercises involving awareness.

PART B

5. **Welding Shop:** Introduction to different welding methods; welding equipment; electrodes; welding joints; welding defects; exercises involving use of gas/electric arc welding.
6. **Electrical and Electronics Shop:** Introduction to electrical wiring; preparation of PCBs involving soldering applied to electrical and electronic applications; exercises preparation of PCBs involving soldering applied to electrical and electronic applications.
7. **Sheet Metal:** Shop development of surfaces of various objects; sheet metal forming and joining operations, joints, soldering and brazing; exercises involving use of sheet metal forming operations for small joints.
8. **Fitting Shop:** Introduction of fitting practice and tools used in fitting shop; exercise involving marking, cutting, fitting practice (Right Angles), male-Female mating parts practice, trapping practice.

Suggested Readings/ Books

1. Raghuwanshi, B.S. ; A course in Workshop technology, Vol 1 & II, Dhanpat Rai & Sons , New Delhi.
2. Jain, R.K.; Production Technology, Khanna Publishers, New Delhi.
3. Singh, S, ; Manufacturing Practice, S.K. Kataria & Sons, New Delhi

BTCH101 Engineering Chemistry

Objective/s and Expected outcome:

The objective of the Engineering Chemistry is to acquaint the student with the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and Engineering field. Some new topics have been introduced to the syllabus for the development of the right attitudes by the engineering students to cope up with the continuous flow of new technology. The student with the knowledge of the basic chemistry, will understand and explain scientifically the various chemistry related problems in the industry/engineering field. The student will able to understand the new developments and breakthroughs efficiently in engineering and technology. The introduction of the new topics will make the engineering student upgraded with the new technologies.

PART A

1. Spectroscopy and its Applications: An introduction

- **UV/Visible Spectroscopy:** Selection rules; Line widths and intensity of spectral lines; Principle and instrumentation; Electronic Transitions; Chromophores & auxochromes; Factors affecting λ_{Max} & intensity of spectral lines; Franck-Condon principle; Applications.
- **IR Spectroscopy:** Principle and instrumentation; Vibrational frequency; Fundamental modes of vibrations and types; Anharmonics; Factors affecting vibrational frequency; Applications.
- **NMR Spectroscopy:** Principle & instrumentation; Chemical shift; Spin-Spin Splitting; High resolution NMR spectrum (PMR only). **(7)**

2. Photochemistry:

Introduction; Photo-physical & photochemical processes; Light sources in photochemistry; Beer-Lambert Law; Laws of Photochemistry; Quantum yield (primary and overall); Primary and secondary photochemical reactions; Jablonski diagram; Semiconductor photochemistry, Photovoltaic cells, Introduction to optical sensors, Introduction to supra-molecular photochemistry. **(5)**

3. Water and its Treatment:

Boiler feed water: Specification, Scales and sludge fermentation; Priming & foaming; Different methods of the water purifications and softening;

Desalination of water; Water for domestic use: Specification; Disinfection of water. **(4)**

4. Green Chemistry and its Applications:

Introductory overview - Definition and concepts of Green chemistry; Emergence of Green chemistry; Twelve principles of Green Chemistry with emphasis on the use of alternative feedstock (bio-fuels); Use of innocuous reagents in natural processes; Alternative solvents; Design of the safer chemicals; Designing alternative reaction methodology. Microwave and ultrasonic radiation in Green synthesis - Minimizing energy consumption. **(4)**

PART B

5. Corrosion and its Prevention:

Introduction; Different types of corrosion - Wet and Dry corrosion; Different types of surface films; Mechanisms of wet corrosion; Galvanic corrosion; Galvanic Series; Concentration cell corrosion and differential aeration corrosion; Soil and microbial corrosions; waterline, stress corrosions; Various methods of corrosion control. **(5)**

6. Polymers and Reinforced Composites:

Introduction; Functionality; Types of polymerization; Specific features of polymers; Structures - regularity and irregularity; Tacticity of polymers; Average molecular weights and size; Determination of molecular weight by number average method; Effect of molecular weight on the properties of polymers; Introduction to polymer reinforced composite. **(5)**

7. Nanochemistry:

Introduction; Materials self-assembly; Moloecular vs. materials self-assembly; Self-assembling materials; Two dimensional assemblies; Mesoscale self assembly; Coercing colloids; Nanocrystals; Superamolecular structures; Nanoscale materials; Future perspectives. **(5)**

8. Petrochemicals:

Introduction; First, second & third generation petrochemicals; Primary Raw Materials for Petrochemicals.

Natural gas: Natural gas treatment processes; Natural gas liquids; Properties of natural gas; Crude oil: Composition of crude oil- Hydrocarbon compounds;

Non-hydrocarbon compounds; Metallic Compounds, Crude oil classification; Physical separation processes; Conversion processes; Production of ethylene and propylene. **(5)**

Suggested Readings / Books

1. William Kemp, Organic Spectroscopy, Palgrave Foundations, 1991.
2. D. A. Skoog, F. J. Holler and A. N. Timothy, Principle of Instrumental Analysis, 5th Edition., Saunders College Publishing, Philadelphia, 1998.
3. G. W. Castellan, Physical Chemistry, Narosa, 3rd Edition, 1995, reprint 2004.
4. C. P. Poole, Jr., F. J. Owens, Introduction to Nanotechnology, Wiley Interscience, 2003.
5. L.E.Foster, Nanotechnology, Science Innovation & Opportunity, Pearson Education, 2007.
6. M. Lancaster, Green Chemistry an Introductory Text, Royal Society of Chemistry, Cambridge, UK, 1st edition, 2010.
7. Sami Matar, Lewis F. Hatch, Chemistry of Petrochemical Processes, Second Edition, Gulf Publishing company, Houston, Texas, 2000.
8. Jones, Denny, Principles and Prevention of Corrosion, Upper Saddle River, New Jersey: Prentice Hall, 2nd edition, 1996.
9. Nicholas J Turro, Modern Molecular Photochemistry, University Science Books, Sausalito, California 2010.
10. Mohamed Belgacem, Alessandro Gandini, Monomers, Polymers and Composites from Renewable Resources, ELSEVIER, 2008.

BTAM102 Engineering Mathematics-II

Objective/s and Expected outcome:

The learning objectives of core mathematics courses can be put into three categories:

Content Objectives: Students should learn fundamental mathematical concepts and how to apply them. **Skill Objectives:** Students should learn critical thinking, modeling/problem solving and effective uses of technology. **Communication Objectives:** Students should learn how to read mathematics and use it to communicate knowledge. The students are expected to understand the fundamentals of the mathematics to apply while designing technology and creating innovations.

PART A

1. Ordinary Differential Equations of first order

Exact Differential equations, Equations reducible to exact form by integrating factors; Equations of the first order and higher degree. Clairaut's equation. Leibniz's linear and Bernoulli's equation

(7)

2. Linear Ordinary Differential Equations of second & higher order

Solution of linear Ordinary Differential Equations of second and higher order; methods of finding complementary functions and particular integrals. Special methods for finding particular integrals: Method of variation of parameters, Operator method. Cauchy's homogeneous and Legendre's linear equation, Simultaneous linear equations with constant coefficients.

(7)

3. Applications of Ordinary Differential Equations

Applications to electric R-L-C circuits, Deflection of beams, Simple harmonic motion, Simple population model.

(7)

PART B

4. Linear Algebra

Rank of a matrix, Elementary transfonnations, Linear independence and dependence of vectors, Gauss-Jordan method to find inverse of a matrix, reduction to normal form, Consistency and solution of linear algebraic equations, Linear transformations, Orthogonal transformations, Eigen values, Eigen vectors, Cayley-Hamilton Theorem, Reduction to diagonal form, orthogonal, unitary, Hermitian and similar matrices. **(7)**

5. Infinite Series

Convergence and divergence of series, Tests of convergence (without proofs): Comparison test, Integral test, Ratio test, Rabee's test, Logarithmic test, Cauchy's root test and Gauss test. Convergence and absolute convergence of alternating series **(7)**

6. Complex Numbers and elementary functions of complex variable

De-Moivre's theorem and its applications. Real and Imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, inverse hyperbolic functions of complex variables. Summation of trigonometric series. (C+iS method) **(7)**

Suggested Readings / Books:

1. Kreyszig,E., Advanced Engineering Mathematics, Eighth edition, John W iley.
2. Michael D. Greenberg., Advanced Engineering Mathematics, Second Edition, Pearson Education.
3. Peter. V. O'Nil, Advanced Engineering Mathematics, Wadsworth- Publishing Company.
4. Jain, R.K. and Iyengar, S.R.K., Advanced Engineering Mathematics, Narosa Publishing House, New Delhi.
5. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi.
6. Pipes, L.A. and Harvill, L.R., Applied Mathematics for Engineers and Physicists, McGraw Hill
7. Taneja, H. C., Engineering Mathematics, Volume-I & Volume-II, 1. K. Publisher.
8. Babu Ram, Advance Engineering Mathematics, Pearson Education.
9. Bindra, J. S., Applied Mathematics, Volume-II, Kataria Publications.

BTME 101 Elements of Mechanical Engineering

Objectives and Expected Outcome:- In the vast spectrum of Mech. Engg., this subject gives a very very primitive but general information finding vide application in day to day life with emphasis upon the principles and fundamentals involved in the inter-conversion of thermal energy into mechanical energy and vice versa, viz. all Automobile, Air-Craft, Generator and other stationary Heat Engines besides cooling machinery like Refrigerators, Air-Conditioners and water-coolers etc. The subject also offers a birds eye-view to all students about the common engineering materials finding vide application in Mech. Engg. Industry and about their strength and other related vital aspects. Since every student of engineering is already exposed to all afore-said machinery, he/she would feel very much self-satisfied and self-confident after learning the basic intricacies and *whys* and *hows* related with the fundamentals of the aforesaid machinery.

PART-A

1. Basic Concepts of Thermodynamics (08)

Definition of thermodynamic: Need to study thermodynamics; Application areas of thermodynamic; Difference between Microscopic (or, Statistical) thermodynamics and Macroscopic(or, Classical) thermodynamics; Brief concept of continuum; **Thermodynamic System** : definition, types (Open, Closed and Isolated) and their examples; **Thermodynamic System Boundary** : definition, types and their examples; **Surroundings**; Control(fixed) mass and Control Volume concept and their example ; Thermodynamic State; **Thermodynamic Property**: definition, types citing their examples; condition for any quantity to be a property; State postulate; Thermodynamic equilibrium (which includes Thermal, Mechanical and Chemical equilibrium etc.); Thermodynamic path; **Thermodynamic process**: definition, **concept of reversible process**, quasi-static (or, quasi-equilibrium) process, irreversible process, conditions for reversibility and how these are met with, non-flow processes and flow processes, method of representation of reversible and irreversible process on property diagrams; Cyclic process; **Thermodynamic Cycle:** definition and its concept; Energy and its forms (microscopic and macroscopic); Physical insight to internal energy; Energy transfer across system boundary i.e. transient energies (heat and work);

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Difference between heat and work; Sign conventions for heat and work interactions; heat and work as path functions; Equality of Temperature and Zeroth law of Thermodynamics.

2. First Law of Thermodynamics and its applications **(12)**

Definition, essence and corollaries or consequences of first law of Thermodynamics; Expressions for First law of Thermodynamics for a control mass undergoing a Cycle and for process (i.e., a change in state of a control mass) ; Concept of Enthalpy and total energy and differentiation between the two - a thermodynamic property; Compressible and incompressible substances, Specific heats, Difference between Internal Energy and Enthalpy of compressible and incompressible substances; Representation of first law of thermodynamics as rate equation; Analysis of non-flow/ flow process for a control mass undergoing constant volume, constant pressure, constant temperature, adiabatic and polytropic processes; Free Expansion Process and its examples, its representation on Property diagram; Review of concepts of control volume; Expressions of first law of thermodynamics for a control volume (i.e. open system) ; Steady State Steady Flow process and its examples; First law analysis of Steady State Flow process e.g. isochoric, isobaric, isothermal, isentropic and polytropic process; Throttling process and its applications; Flow energy or inertial energy of flowing fluids or, Energy transport by mass; Application of Steady State Flow Energy Equation to various engineering devices.

3. Second Law of Thermodynamics **(16)**

Limitations of first law of thermodynamics; and how 2nd law is fully able to explain away and thus overcome those shortcomings of Ist law; Thermal Reservoirs, source and sink (Low temperature and high temperatures); **Heat Engine, Heat Pump and Refrigerator**: definitions, working, efficiency/performance and their real life examples. Justification as to why the actual efficiency of Heat Pump and Refrigerator shall also be ≤ 100% though on the face of it seems to be more than 100%; Various statements of Second Law of Thermodynamics and their equivalence; Philosophy of Carnot cycle and its consequences viz. how each of the individual four processes constituting the cycle contribute in optimizing the output and efficiency of the cycle; **Carnot Engine, Carnot Refrigerator and Carnot Heat Pump:** definitions, working, efficiency/performance and Limitations of the cycle; Carnot theorem for heat engines, refrigerators and heat pumps; derivation of Carnot efficiency/COP (which seems to be more than 100%); Thermodynamic Temperature Scale; Clausius theorem and Inequality; Philosophy and concept of entropy; Entropy changes during various processes; Temperature - Entropy Chart and representation of various processes on it; Principle of Increase of Entropy; Applications of Entropy Principle; Quality of Energy viz. high and low grade energies; Degradation of Energy; Third Law of Thermodynamics.

PART-B

4. Gas Power Cycles **(12)**

Introduction; Concept and philosophy of Air Standard Cycle alongwith associated assumptions and advantages; Air Standard Efficiency; Nomenclature of reciprocating piston-cylinder arrangement with basic definitions such as swept volume, clearance volume, compression ratio, mean effective pressure etc; Otto Cycle (or constant volume heat addition cycle), Diesel cycle (or constant pressure heat addition cycle) and Dual cycle (Mixed or Composite or Limited Pressure cycle) with their representation on P-V and T-S charts, their Air-standard (thermal) Efficiencies; Brayton Cycle, Comparison of Otto, Diesel and Dual cycle under some defined similar parametric conditions; Introduction to heat engines; Merits of I.C. Engines and their important applications, Classification and constructional features of I.C. Engines; working of two stroke and four stroke Petrol and Diesel engines and their comparison.

5. Engineering Materials **(05)**

Materials and Civilization, Materials and Engineering, Classification of Engineering Materials, Mechanical Properties of Materials: elasticity, plasticity, strength, ductility, brittleness, melleability, toughness, resilience, hardness, machinability, formability, weldability. Properties, Composition, and Industrial Applications of materials: metals (ferrous- cast iron, tool steels, stainless steels and non ferrous- Aluminum, brass, bronze), polymers (natural and synthetic , thermoplastic and thermosetting), ceramics (glass, optical fibre glass, cements), composites (fibre reinforced, metal matrix), smart materials (piezoelectric, shape memory, thermochromic, photochromic, magnetorheological), Conductors, Semiconductors and insulators, Organic and Inorganic materials. Selection of materials for engineering applications.

6. Centroid, Centre of Gravity and Moment of Inertia: (08)

Difference between centre of gravity and centroid. Determination of position of centroid of plane geometric figures of I, U, H, L, T, C, Circular and Triangular Sections. Centroid of Composite Areas. Determination of position of Centre of Gravity (CG) of regular solids viz. Right Circular Cone, Solid Hemisphere, thin Hollow Hemisphere. Area moment of inertia & mass moment of inertia, Polar moment of inertia, Parallel axes Theorem (or transfer formula), Perpendicular axes Theorem, Radius of gyration, determination of area Moment of Inertia of I, U, H, L, T, C, Circular and Triangular Sections along various axes. Mass moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their axis of symmetry and other axes.

Suggested Readings / Books

1. Nag P.K., Engineering Thermodynamics, Tata McGraw Hill.
2. Yadav R., Thermodynamics and Heat Engines, Central Publishing House, Allahabad
3. Rogers G. and Mayhew Y., Engineering Thermodynamics, Pearson Education.
4. Cengel Y.A. and Boles M.A., Thermodynamics - An Engineering Approach, Tata McGraw Hill.
5. Rao Y.V.C., An Introduction to Thermodynamics, New Age International (P) Limited Publishers.
6. Spalding D. B., Cole E. H., Engineering thermodynamics, ELBS series
7. Bedi D.S., Element of Mechanical Engineering, Khanna Publishers New Delhi
8. Donald R. Askeland, Pradeep P. Phule, Essentials of materials Science and Engineering, Cenage Learning
9. A.K.Tayal Engineering Mechanics, Umesh Publications.

BTCS 101 Fundamentals of Computer Programming and IT

Objective/s and Expected outcome:

To familiarize the students of all branches in engineering with computer organization, operating systems, problem solving and programming in C++. After the students have successfully completed the course, they shall have sufficient knowledge of the basic computer operations and various programming techniques especially in C++.

PART A (Fundamentals of Computer and IT) (25%)

1. Introduction to Computers

Define a Computer System, Block diagram of a Computer System and its working, associated peripherals, memories, RAM, ROM, secondary storage devices, Computer Software and Hardware. **(2)**

2. Working Knowledge of Computer System

Introduction to the operating system, its functions and types, working knowledge of GUI based operating system, introduction to word processors and its features, creating, editing, printing and saving documents, spell check, mail merge, creating power point presentations, creating spreadsheets and simple graphs, evolution of Internet and its applications and services. **(3)**

3. Problem Solving & Program Planning

Need for problem solving and planning a program; program design tools - algorithms, flow charts, and pseudocode; illustrative examples. **(2)**

PART B (Basics of Programming Using C++) (75%)

4. Overview of C++ Language

Introduction to C++ language, structure of a C++ program, concepts of compiling and linking, IDE and its features; Basic terminology - Character set, tokens, identifiers, keywords, fundamental data types, literal and symbolic constants, declaring variables, initializing variables, type modifiers.

(3)

5. Operators and expressions

Operators in C++, precedence and associativity of operators, expressions and their evaluation, type conversions.

(2)

6. Beginning with C++ program

Input/output using extraction (>>) and insertion (<<) operators, writing simple C++ programs, comments in C++, stages of program execution.

(4)

7. Control Structures

Decision making statements: if, nested if, if - else. Else if ladder, switch, Loops and iteration: while loop, for loop, do - while loop, nesting of loops, break statement, continue statement, goto statement, use of control structures through illustrative programming examples.

(4)

8. Functions

Advantages of using functions, structure of a function, declaring and defining functions, return statement, formal and actual arguments, const argument, default arguments, concept of reference variable, call by value, call by reference, library functions, recursion, storage classes. Use of functions through illustrative programming examples.

(4)

9. Arrays and Strings

Declaration of arrays, initialization of array, accessing elements of array, I/O of arrays, passing arrays as arguments to a function, multidimensional arrays. String as array of characters, initializing string variables, I / O of strings, string manipulation functions (strlen, strcat, strcpy, strcmp), passing strings to a function. Use of arrays and strings through illustrative programming examples.

(4)

10. Concepts of Object Oriented Programming

Introduction to Classes, Objects, Data abstraction, Data encapsulation, inheritance and polymorphis.

(2)

11. Classes and Objects

Defining classes and declaring objects, public and private keywords, constructors and destructors, defining member functions inside and outside of a class, accessing members of a class, friend function. Use of classes and objects through illustrative programming examples.

(4)

12. Basics of File Handling

Opening, reading, and writing of files, error handling during files operation. **(2)**

Suggested Readings/ Books

1. E. Balagurusamy, Object-Oriented Programming with C++, Tata McGraw Hill.
2. P. K. Sinha and Priti Sinha, Computer Fundamentals, BPB Publications.
3. Lafore R., Object Oriented Programming in C++, Waite Group.
4. Bjarne Stroustrup, The C++ Programming Language, Addison Wesley.
5. Lippman F. B, C++ Primer, Addison Wesley.
6. R. S. Salaria, Computer Concepts and Programming in C++, Salaria Publishing House.
7. Gurvinder Singh, Krishan Saluja, Fundamentals of Computer Programming & IT, Kalyani Publishers.
8. R. S. Salaria, Fundamentals of Computers, Salaria Publishing House.

HVPE 101 Human Values & Professional Ethics

Objective/s and Expected outcome:

To help the students to discriminate between valuable and superficial in the life. To help develop the critical ability to distinguish between essence and form, or between what is of value and what is superficial, in life - this ability is to be developed not for a narrow area or field of study, but for everyday situations in life, covering the widest possible canvas. To help students develop sensitivity and awareness; leading to commitment and courage to act on their own belief. It is not sufficient to develop the discrimination ability, it is important to act on such discrimination in a given situation. Knowingly or unknowingly, our education system has focused on the skill aspects (learning and doing) - it concentrates on providing to its students the skills to do things. In other words, it concentrates on providing "How to do" things. The aspects of understanding "What to do" or "Why something should be done" is assumed. No significant cogent material on understanding is included as a part of the curriculum. A result of this is the production of graduates who tend to join into a blind race for wealth, position and jobs. Often it leads to misuse of the skills; and confusion and wealth that breeds chaos in family, problems in society, and imbalance in nature. This course is an effort to fulfill our responsibility to provide our students this significant input about understanding. This course encourages students to discover what they consider valuable. Accordingly, they should be able to discriminate between valuable and the superficial in real situations in their life. It has been experimented at IIITH, IITK and UPTU on a large scale with significant results.

PART A

1. **Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**
   - Understanding the need, basic guidelines, content and process for Value Education.

- Self Exploration-what is it?- its content and process; „Natural Acceptance" and Experiential Validation- as the mechanism for self exploration.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfill the above human aspirations: understanding and living in **harmony** at various levels **(6)**

2. Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient „I" and the material „Body"
- Understanding the needs of Self („I") and „Body" - *Sukh* and *Suvidha*
- Understanding the Body as an instrument of „I" (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of „I" and harmony in „I"
- Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure *Sanyam* and *Swasthya* **(6)**

3. Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

- Understanding harmony in the Family- the basic unit of human interaction
- Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship
- Understanding the meaning of *Vishwas*; Difference between intention and competence
- Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals

- Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj*), Universal Order (*Sarvabhaum Vyawastha*)- from family to world family! **(6)**

PART B

4. Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence **(4)**

5. Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:
  - Ability to utilize the professional competence for augmenting universal human order
  - Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems
  - Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order:
  - At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  - At the level of society: as mutually enriching institutions and organizations **(6)**

Recommended Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education.*

Suggested Readings / Books:

2. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
3. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
4. A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
5. Sussan George 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
6. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
7. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers
8. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
9. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth - Club of Rome's report*, Universe Books.
10. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers* , Oxford University Press
11. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd
12. B P Banerjee, 2005, *Foundations of Ethics and Management,* Excel Books.
13. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.

BTCH 102 Engineering Chemistry Laboratory

1. Analysis of Effluents

- Determination of water by EDTA method.
- Determination of H_2O by dissolved oxygen analyzer.
- Determination of turbidity by Nephelometer
- Determination of Residual Chlorine.

2. Analysis of Fuels and Lubricants

- Determination of Moisture, Volatile and ash content by proximate analysis. □ Determination of Flash & Fire point by Abee"s Apparatus
- Determination of the viscosity.
- Determination of Acid Value and Aniline point of oil
- Determination of refractive index for oils.

3. Instrumental Analysis

- Determination λ-max by spectrophotometer and determination of unknown conc of binary mixture of two liquids.
- Determination of the surface tension by stalagmometer
- Determination of the concentration of a solution conductometerically.
- Determination of the strength of a solution pH meterically.
- Distinction between acid, ester, ketone using IR spectrophotometer.
- Determination of bathochromic shifts, hypsochromic and hyperchromic, hypochromic shift of benzene and its derivatives

4. Chromatography

- Determination of Rf value of amino acid by TLC and identification of the amino acid present.
- Separation of metallic ions by paper chromatography. □ Separation of Ions by using complexing agents
- Separation of plant pigments, Chlorophyll and carotenoids by column chromatography.
- Determination of the ion exchange capacity of the given ion exchanger. □ Separation of ions by ion-exchange method.

5. Synthesis & Green Chemistry experiments

- Preparation of a polymer phenol/urea formaldehyde resin or hexamethylenediamine adipic acid polymer and determination of carbonyl value or acid value.
- Preparation of aspirin.
- Preparation of ethyl-2-cyano-3-(4"-methoxyphenyl)-propeonate (Microwave assisted reaction)
- Base catalyzed aldol condensation by Green Methodology
- Acetylation of primary amines using ecofriendly method.

Note: Each student is required to perform two experiments from each of the 5 titles (presented bold) depending on his/her Branch and Aptitude.

Suggested Readings / Books

1. Vogel A-I, Quantitative Inorganic Analysis, Oxford ELBS
2. Vogel A-I, Quantitative Organic Analysis, Oxford ELBS

3. dst.gov.in/green-chem.pdf (monograph of green chemistry laboratory experiments)

BTME 102 Engineering Drawing

Objective and Expected Outcome:

Main objective of the Engineering Drawing is to introduce the students to visual science in the form of technical graphics. General instructions related to Theory of Orthographic Projection of points, lines, planes and solids as per the BIS codes prevalent to drawing practice will be introduced initially. Section of solids, intersection and development of surfaces, isometric projection and orthographic projection of simple solids/blocks will further upgrade the basic understanding and visualization of geometrical objects and to certain extent the machine parts. Computer graphics will enable the students to strengthen the understanding through hands on training on any CAD software wherein they will be introduced to a number of assignments as mentioned in the said course.

PART A

1. Introduction

Engineering Drawing/Engineering Graphics/Technical Drawing - a Visual Science. Types of Engineering Drawing, Introduction to drawing equipment and use of instruments. Symbols and conventions in drawing Practice. Types of lines and their use, BIS codes for lines, Technical lettering as per BIS codes, Introduction to Dimensioning, Concepts of scale in drawing, Types of scales. Basic Definition of geometrical objects: Points, lines, planes and solids.

2. Theory of Projections

Relevance of projection, Type of projections, Perspective, Orthographic, Axonometric and their basic principles, System of orthographic projection: in reference to quadrants and octants, illustration through simple problems of projection.

3. Projection of Points

Projection of points in quadrants and octants. Projection of point on Auxiliary planes.

4. Projection of Lines

Parallel to both H P and V P. Parallel to one and inclined to other, and inclined to both, contained in profile plane. True length and angle orientation of straight line: rotation method and auxiliary plane method. Distance between two nonintersecting lines, and trace of line.

5. Projection of Planes

Difference between plane and lamina. Projection of lamina Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, and Lamina oblique to three reference planes. Application of auxiliary planes, and trace of planes.

6. Projection of Solids

Definition of solids types of solids, and elements of solids. Projection of solids in first or third quadrant, with axis parallel to one and perpendicular to other, axis parallel to one inclined to other, axis inclined to both the principle plane, axis perpendicular to profile plane and parallel to both H P and V P. Visible and invisible details in the projection. Use rotation and auxiliary plane method to draw the projections.

PART B

7. Section of Solids

Definition of Sectioning and its purpose. Procedure of Sectioning, Types of sectional planes. Illustration through examples.

8. Intersection of Surfaces/Solids

Purpose of intersection of surfaces Intersection between the two cylinder, two prisms, prism and pyramid, pyramid and pyramid, cylinder and prism, cone and cylinder, sphere and cylinder etc., use of cutting plane and line method.

9. Development of Surface

Purpose of development. Parallel line, radial line and triangulation method. Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, and development of surface of sphere.

10. Isometric Projection

Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder, and assignments on isometric projection of simple machine parts.

11. Orthographic Projection

Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.

Suggested Readings / Books

1. Narayana K L and Kanaiah P, "Engineering Graphics", Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Gill P S, "Engineering Graphics and Drafting", Katria and Sons, Delhi.
3. Bhat N D, "Elementary Engineering Drawing-Plane and solid Geometry", Chartotar Publishing House, Anand.
4. Luzzadde Warren J, "Fundamentals of Engineering Drawing", Prentice Hall of India Private Limited, New Delhi.
5. Bertoline G R , Wiebe E N, Miler G L L & Mother J L, "Technical Graphics Communication", Irwin McGraw Hill, New York.
6. A Text Book of Engg Drawing by R. K. Dhawan, S. Chand and Co. Ltd

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BTCS102 Fundamentals of Computer Programming and IT

1. **Familiarization with the Computer System:**
   - To explain the part of the computer system such as system unit, input devices, output devices connected to the computer.
   - To explore the outside view of the system unit that includes the panels on front and ports at the rear
   - To explore the inside view of the system unit that includes the motherboard, processor, expansion slots, various add-on cards, storage devices, power supply, fans.
   - To understand the booting process that includes switching on the system, execution of POST routine, then bootstrap loader, and loading of the operating system, and getting it ready for use.
   - To introduce the graphical user interface (desktop) of Windows operating system
     - to explain the various elements of the desktop such as taskbar, icons (My Computer, Recycle Bin, etc.), short cuts, notification area.
     - to configure the desktop that include selecting the wall paper, selecting the screen saver with or without password protection, selecting the screen resolution and color quality.
2. **Navigating with Window Explorer:**
   - To navigate with the drives
   - To create new folders
   - To move folders from one drive to another drive
   - To move files from one folder to another folder
   - To search files and folders
   - To share files and folders
   - To view and/or change the attributes of the files and folders
3. **Working with Control Panel:**
   - To work with date and time
   - To create new user accounts
   - To install new hardware and configuring existing hardware
   - To install new software or remove existing installed software

□ To configure network connections □

To manage security profile

4. **Miscellaneous Features:**

□ To work at the command prompt

□ To open an application, folder, document or internet resource from the Run command

□ To initialize storage media (formatting)

□ To understand the menace of viruses

□ To understand the working of virus guards and antivirus s oftware

5. **Exploring the Internet:**

□ To understand the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers, web servers, mail-servers, etc. □ To create email-account, sending mails, receiving mails, sending files as attachments, etc

□ To login to a remote computer

□ To search information using search engines

6. **Microsoft Word:**

□ To familiarize with parts of Word window □ To create and save a document

□ To set page settings, create headers and footers □ To edit a document and resave it

□ To use copy, cut and paste features

□ To use various formatting features such as bold face, italicize, underline, subscript, superscript, line spacing, etc.

□ To use spelling and grammar checking feature □ To preview print a document

7. **Microsoft Word continued:**

□ To create a table with specified rows and columns □ To enter data in a table

□ To select a table, a row, a column or a cell

□ To inset new row and/or a column

□ To delete a row and/or a column

□ To split and merge a row, column or a cell

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- To understand the mail-merge and to use mail merge feature of MS-Word

8. Microsoft Excel:

- To familiarize with parts of Excel window
- To create and save a workbook with single and/or multiple worksheets To edit and format text as well numbers
- To apply operations on range of cells using built-in formulae To preview and print a worksheet

9. Microsoft Excel continued:

- To insert new row and/or column in a worksheet To delete a row and/or column in a worksheet To create a variety of charts
- To import and export data to or from worksheet

10. Microsoft PowerPoint:

- To familiarize with parts of PowerPoint window To create and save a new presentation
- To apply design templates to a presentation To insert, edit and delete a slide
- To use different views of slides
- To use slide show from beginning or from the current slide To preview and print a presentation

11. Microsoft PowerPoint continued:

- To check spellings in a presentation
- To add clip art and pictures in a slide
- To add chart, diagram and table in a slide
- To set animation for a selected slide and/or for entire presentation To create slide master and title master
- To create a custom show

12. Write a program to find the nature of the roots as well as value of the roots. However, in case of imaginary roots, find the real part and imaginary part separately.

13. Write a program which takes two integer operands and one operator form user, performs the operation and then prints the result. (Consider the operators +,-,*, /,

% and use *switch* statement).For example, the input should be in the form: 5 + 3 the output should comes Result = 8

14. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a program to generate the first *n* terms of the sequence. For example, for $n = 8$, the output should be 0 1 1 2 3 5 8 13

15. Write a program to print all the prime numbers between *m* and *n*, where the value of *m* and *n* is supplied by the user.

16. The number such as 1991, is a palindrome because it is same number when read forward or backward. Write a program to check whether the given number is palindrome or not.

17. A positive integer number IJK is said to be *well-ordered* if $I<J<K$. For example, number 138 is called *well-ordered* because the digits in the number (1, 3, 8) increase from left to right, *i.e.*, $1 < 3 < 8$. Number 365 is not *well-ordered* because 6 is larger than 5. Write a program that will find and display all possible three digit *well-ordered* numbers. The program should also display the total number of three digit *well-ordered* numbers found.

18. Write a function to computer the highest common factor of integer numbers *m* and *n*. Use this function to find the highest common factor of integer numbers *a* and *b*.

19. Given the marks (out of 100) obtained by each student in a test of a class with *n* students. Write a program to obtain the following information:

(*a*) minimum and maximum marks score

(*b*) average score of the class, and

(*c*) number of students whose score is greater than class's average score

20. Write a program to multiply matrix $A_{m \times n}$ by $B_{p \times q}$, given that $n = p$.

21. Write a program to sort a list of *n* integer numbers in descending order using bubble sort method.

22. Create a class named *Student* with the appropriate data members and member functions to generate output comprising student's admission no., name, marks in five subjects and the %age of marks obtained. Write a program to use the *Student* class.

23. Create a class named *ComplexNumber* with the appropriate data members and constructors. Include member functions (defined inside the class) to perform the following operations:

(*a*) Inputting a complex number

(*b*) Outputting a complex number

(*c*) Arithmetic operations on two complex numbers

Write an appropriate program to demonstrate use of the *ComplexNumber* class.

24. Create a class named *Height* with *feet* and *inches* as its data members. Also include appropriate constructors (and destructor, if required). Include member functions (defined outside the class) to perform the following operations:

(*a*) Inputting a height of a person

(*b*) Displaying a height of a person

(*c*) To get height in inches

(*d*) To compare two heights

Write an appropriate program to demonstrate use of the *Height* class.

Note: Students are required to prepare a file containing lab exercises based on programming only, where as the oral examination will from the entire syllabus.

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BTME 103 Engineering Computer Graphics Laboratory

Objective/s and Expected outcome:

Main objective of the Engineering Drawing is to introduce the students to visual science in the form of technical graphics. General instructions related to Theory of Orthographic Projection of points, lines, planes and solids as per the BIS codes prevalent to drawing practice will be introduced initially. Section of solids, int ersection and development of surfaces, Isometric projection and orthographic projection of simple solids/blocks will further upgrade the basic understanding and visualization of geometrical objects and to certain extent the machine parts.

Lab Work I: Involves hands-on practice sessions related to 2-D computer sketching.

Exercise 1: Study and draw 2-D sketching entities like lines, rectangle, parellelogram polygon, circle etc.. under SKETCH ENTITY MENU.

Exercise 2: (a) Rectangular array (b) Circular array

Exercise 3: Sketch of Metal grate

Exercise 4: Slotted Base

Exercise 5: Link

Exercise 6: Base Plate (Extruding the sketch)

Exercise 7: Bush (Revolve)

Exercise 8: Handle (Revolve)

Exercise 9: Flange coupling parts

Exercise 10: Bell Crank Lever

Lab Work-II: Using the geometric shape and size data learnt in Lab Work I, extrude or revolve the sketch to obtain 3-D drawing. Study and practice various options available for 3-D drawing.

Exercise-1: Bracket Lever

Exercise 2: Hand Wheel

Exercise 3: Hexagonal Nut and Bolt

Exercise 4: Keys

Exercise 5: Body of Solid Journal Bearing

Exercise 6: Shaft

Exercise 7: Cup of Screw Jack

Exercise 8: Screw Jack Body

Exercise 9: V-Block

Exercise 10: Gland

PUNJAB TECHNICAL UNIVERSITY

Scheme& Syllabus of
B. Tech. Electronics & Communication Engineering [ECE]

Batch 2011

By

Board of Studies Electronics & Communication Engineering

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Third Semester **Contact Hours: 29 Hrs.**

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTAM-301	Engineering Mathematics-III	4	1	-	40	60	**100**	**5**
BTCS-305	Object Oriented Programming using C++	3	1	-	40	60	**100**	**4**
BTEC-301	Analog Devices & Circuits	3	1	-	40	60	**100**	4
BTEC-302	Digital Circuit and Logic Design	3	1	-	40	60	**100**	4
BTEC-303	Network Analysis and Synthesis	3	1	-	40	60	**100**	**4**
BTEC-304	Lab Analog Devices & Circuits	-	-	2	30	20	**50**	**1**
BTEC-305	Lab Digital Circuit and Logic Design	-	-	2	30	20	**50**	**1**
BTCS-309	Lab Object Oriented Programming	-	-	4	30	20	**50**	**2**
Workshop Training *					60	40	**100**	
	TOTAL	**16**	**5**	**8**	**350**	**400**	**750**	**25**

***The marks will be awarded on the basis of 4 weeks workshop training conducted after 2nd Semester**

Fourth Semester **Contact Hours: 32 Hrs**

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTEE-402	Linear Control Systems	4	1	-	40	60	**100**	**5**
BTEC-401	Analog Communication Systems	3	1	-	40	60	**100**	**4**
BTEC-402	Signal & Systems	3	1	-	40	60	**100**	**4**
BTEC-403	Electromagnetics & Antennas	4	1	-	40	60	**100**	**5**
BTEC-404	Electronic Measurement & Instrumentation	3	1	-	40	60	**100**	**4**
BTEC-405	Pulse Wave Shaping and Switching	3	1	-	40	60	**100**	**4**
BTEC-406	Lab Analog Communication Systems	-	-	2	30	20	**50**	**1**
BTEC-407	Lab Electronic Measurement & Instrumentation	-	-	2	30	20	**50**	1
BTEC-408	Lab Signal & Systems using MATLAB/Mentor DSP	-	-	2	30	20	**50**	**1**
General Fitness					100	NA	**100**	
	TOTAL	**20**	**6**	**6**	**430**	**420**	**850**	**29**

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Fifth Semester **Contact Hours: 30 Hrs**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTCS-304	Data Structures	3	1	-	40	60	**100**	**4**
BTEC-501	Digital Communication System	3	1	-	40	60	**100**	**4**
BTEC-502	Digital Signal Processing	4	1	-	40	60	**100**	**5**
BTEC-503	Linear Integrated Circuit	3	1	-	40	60	**100**	**4**
BTEC-504	Micro processors & Micro controllers.	4	1	-	40	60	**100**	**5**
BTEC-505	Lab Digital Signal Processing	-	-	2	30	20	**50**	**1**
BTEC-506	Lab Linear Integrated Circuit	-	-	2	30	20	**50**	**1**
BTEC-507	Lab Digital Communication System	-	-	2	30	20	**50**	**1**
BTEC-508	Lab Hardware Programme & Interfacing	-	-	2	30	20	**50**	**1**
Industrial Training *					60	40	**100**	**1**
	TOTAL	**17**	**5**	**8**	**380**	**420**	**800**	**26**

***The marks will be awarded on the basis of 06 weeks workshop training conducted after 4th Semester**

Sixth Semester **Contact Hours: 30 Hrs**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTCS-401	Operating Systems	3	1	-	40	60	**100**	**4**
BTEC-601	Microwave & Radar Engineering	4	1	-	40	60	**100**	**5**
BTEC-602	Wireless Communication System	3	1	-	40	60	**100**	**4**
BTEC-603	Engineering Economics & Industrial Management	3	1	-	40	60	**100**	**4**
BTEC-604	VLSI Design	4	1	-	40	60	**100**	**5**
BTEC-XXX	Elective-I	3	1	-	40	60	**100**	**4**
BTEC-605	Lab VLSI	-	-	2	30	20	**50**	**1**
BTEC-606	Lab Microwave Engineering	-	-	2	30	20	**50**	**1**
General Fitness					100	NA	**100**	
	TOTAL	**20**	**6**	**4**	**400**	**400**	**800**	**28**

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Seventh / Eighth Semester **Contact Hours: 30 Hrs.**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BTCS-403	Computer Networks	3	1	-	40	60	**100**	**4**
BTEC-701	Embedded Systems	3	1	-	40	60	**100**	**4**
BTEC-702	Optical Communication	3	1	-	40	60	**100**	4
BTEC-YYY	Elective-II	3	1	-	40	60	**100**	4
BTEC-ZZZ	Elective-III	3	1	-	40	60	**100**	**4**
BTEC-703	Lab Wireless and Optical Systems & Networks	-	-	2	30	20	**50**	**1**
BTEC-704	Lab Embedded Systems	-	-	2	30	20	**50**	**1**
BTEC-705	Major Project	-	-	6	100	50	**150**	**3**
General Fitness					100	NA	**100**	
	TOTAL	**15**	**5**	**10**	**460**	**390**	**850**	**25**

Seventh / Eighth Semester

Course Component	Internal Marks	External Marks	Total Marks
For Software Training *	150 Marks	100 Marks	250 Marks
For Industry Oriented Project Training	300 Marks	200 Marks	500 Marks

Note:
*The institution may provide training on any of the softwares from amongst
- □ ORCAD,
- □ MATLAB,
- □ Mentor DSP,
- □ MULTISIM,
- □ OPTSIM,
- □ OPTISYSTEM
- □ NS2
- □ OPNET etc.
- □ QUALNET □
- □ ULTIBOARD□
- □ XILINX□
- □ MODELSIM/ QUESTA SIM□ □

KIEL etc. □

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Departmental Elective - I (Common Code XXX)

BTEC 901 Relational Data Base Management System
BTEC 902 Micro Electronics
BTEC 903 Industrial Electronics
BTEC 904 Digital System Design
BTEC 905 Intellectual property rights & patent systems
BTEC 906 Intelligent Instrumentation
BTEC 907 Information Theory & Coding
BTIT 702 Software Project Management

Departmental Elective -II (Common Code YYY)

BTEC 908 CMOS based design
BTEC 909 Biomedical signal processing
BTEC 910 Satellite Communication
BTEC 911 Artificial Intelligence Techniques & Applications
BTEC 912 Speech & image Processing
BTEC 913 Human Resource Management
BTEC 914 Computer organization and Architecture
BTIT 501 Cyber Law & IPR

Departmental Elective - III (Common Code ZZZ)

BTEC 915 Electromagnetic interference & compatibility
BTEC 916 Neural Networks & Fuzzy logic
BTEC 917 Robotics
BTEC 918 Operation Research
BTEC 919 Mobile Computing
BTEC 920 Wireless Sensor network
BTEC 921 Numerical Methods

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Third Semester

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BTAM301 Engineering Mathematics-III

Unit I Fourier Series: Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.

Unit II Laplace Transforms: Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

Unit III Special Functions: Power series solution of differential equations, Frobenius method, Legendre's equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind. Recurrence relations, equations reducible to Bessel's equation.

Unit IV Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients.

Unit V Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

Unit VI Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable. Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

Suggested Readings/ Books:

□ Kreyszing, E., Advanced Engineering Mathematics, Eighth edition, John Wiley, New Delhi. □
Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
□ Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957. □
Peter. V. O'Nil, Advanced Engineering Mathematics, Wadsworth Publishing Company. □ Taneja,
H. C., Engineering Mathematics, Volume-I & Volume-II, I. K. Publisher.
Babu Ram, Advance Engineering Mathematics, Pearson Education.
Bindra, J. S., Applied Mathematics, Volume-III, Kataria Publications.
Advanced Engineering Mathematics, O'Neil, Cengage Learning.

BTCS 305 Object Oriented Programming Using C++

Unit I Object-Oriented Programming Concepts: Introduction, comparision between procedural programming paradigm and object-oriented proramming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

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Unit II Standard Input/Output: Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and memberv functions of i/o stream classes, formatting output, formatting using ios class functions and flags, formatting using manipulators.

Unit III Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of *const* keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

Unit IV Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using *new* and *delete* operators, pointer to an object, *this* pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Unit V Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists.

Unit VI Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Unit VII Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors.

Unit VIII Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract clasess, virtual destructors.

Unit IX Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

Unit X Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples.

Unit XI Files: File streams, hierarchy of file stream classes, error handling during file operations, reading/writing of files, accessing records randomly, updating files.

Suggested Readings/ Books:

- Lafore R., **Object Oriented Programming in C++**, Waite Group.
- E. Balagurusamy, **Object Oriented Programming with C++**, Tata McGraw Hill.
- R. S. Salaria, **Mastering Object-Oriented Programming with C++**, Salaria Publishing House.
- Bjarne Stroustrup, **The C++ Programming Language**, Addison Wesley.
- Herbert Schildt, **The Complete Reference to C++ Language**, McGraw Hill-Osborne.
- Lippman F. B, **C++ Primer,** Addison Wesley.

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BTEC301 Analog Devices & Circuits

Unit I Semiconductor diode Theory of PN junction diode, Band structure of open circuited PN junction, Volt Ampere Characteristics, Temperature Dependence of PN diode, LED, LCD and Photo- diodes, Tunnel diode, Zener diode as Voltage Regulator.

Unit II Transistors, Characteristics and Biasing Transistor, Types of Transistor, Transistor current components, Transistor as an Amplifier, Transistor characteristics in CB, CE and CC modes. Operating point, bias stability, various biasing circuits, stabilization against Ico, V_{BE} and beta, Construction, Characteristics & applications of Junction Field Effect Transistor (JFET), UJT and MOSFET.

Unit III Large Signal Amplifiers: Class A direct coupled with resistive load, Transformer coupled with resistive load, harmonic distortion, variation of output power with load, Push-Pull Amplifiers, operation of class- B push-pull amplifier, crossover distortion, transistor phase inverter, complementary- symmetry amplifier.

Unit IV Feedback Amplifiers and Oscillator: Feedback Concept, Effect of negative feedback on gain, bandwidth, stability, distortion and frequency Response, Sinusoidal Oscillators, Sinusoidal oscillators; criterion for oscillation, Different types of oscillators: RC Phase Shift, Wein Bridge, Hartley, Colpitts and Crystal Oscillators. Derivation of expression for frequency and amplitude of these oscillators.

Unit V Low & High Frequency Transistor Model: Transistor Hybrid Model, h parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, The high frequency T model, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters.

Suggested Readings/ Books:

- Electronic Devices & Circuits by Millman- Halkias, Tata Mcgraw Hill
- Electronic Devices & Circuits Theory by Boylested, Pearson Education.
- Electronic Fundamentals & Application, by J.D. Ryder, PHI.
- Electronic Devices, by Floyd, Pearson Education.
- Electronics Devices & Circuits by J.B.Gupta, Katson.

BTEC302 Digital Circuit and Logic Design

Unit I Number System and Binary Code: Introduction, Binary, Octal and Hexadecimal Number System (Conversion, Addition & Subtractions). Signed and unsigned numbers, Binary Subtractions using 1's and 2's compliment, ASCII code, Excess 3 code, Grey code, BCD code and BCD additions.

Unit II Minimization of logic function: OR, AND,NOT,NOR,NAND,EX-OR, EX-NOR, Basic theorem of Boolean Algebra, Sum of Products and Product of Sums, canonical form, Minimization using K-map and Q-M method.

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Unit III Combinational Circuits: Introduction, Combinational circuit design, Encoders, decoders, Adders, Subtractors and Code converters. Parity checker, seven segment display, Magnitude comparators. Multiplexers, De-multiplexer, Implementation of Combinational circuit using MUX.

Unit IV Sequential Circuits: Introduction, flip flops, Clocked flip flops, SR, JK, D, T and edge triggered flipflops. Excitation tables of Flip flops. Shift Registers, Type of Shift Registers, Counter, Counter types, counter design with state equation and state diagrams.

Unit V D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A converter, steady state accuracy test, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter Successive approximation A/D converter. Single and dual slope A/D converter, A/D accuracy and resolution.

Unit VI Semiconductor Memories: Introduction, Memory organisation, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories. Content addressable memories. PLA and PAL.

Unit VII Logic Families: RTL, DCTL, DTL, TTL, ECL, CMOS and its various types, Comparison of logic families.

Suggested Readings / Books:

- Morris Mano, **Digital Design**, Prentice Hall of India Pvt. Ltd
- Donald P.Leach and Albert Paul Malvino, **Digital Principles and Applications**, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
- R.P.Jain, Modern **Digital Electronics**, 3 ed., Tata McGraw-Hill publishing Company limited, New Delhi, 2003.
- Thomas L. Floyd, **Digital Fundamentals**, Pearson Education, Inc, New Delhi, 2003
- Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, **Digital System -Principles and Applications**, Pearson Education.
- Srivastava/Srivastava/Srivastava, **Digital Design: HDL Based Approach,** Cengage Learning.
- Roth, **Fundamentals of Logic Design,** Cengage Learning

BTEC303 Network Analysis and Synthesis

Unit I Circuit Concepts: Independent and dependent sources, Signals and wave forms: Periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity.

Unit II Time and Frequency Domain Analysis: Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, Time domain behaviors from poles and zeros, Convolution Theorem.

Unit III Network Synthesis: Network functions, Impedance and admittance function, Transfer functions, Relationship between transfer and impulse response, poles and zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles and zeros, Real liability condition for impedance synthesis of RL and RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Unit IV: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, Pass bands and stop bands, Design of constant-K, m-derived filters, Composite filters.

Suggested Readings/ Books:

Bird John, *Electrical Circuit Theory and Technology*, 2nd Ed., Newnes. □
Chakraborty, Abhijit, *Circuit Theory*, 2nd Edition, Dhanpat Rai, 2001. □
Chaudhury D. Roy, *Networks and Synthesis*, New Age International. □
Edminister J.A., *Electric Circuits*, 4th Edition, Tata McGraw Hill, 2002. □ Iyer
T.S.K.V., *Circuit Theory*, Tata McGraw Hill, 2006.
□ Mohan, Sudhakar Sham, *Circuits and Networks Analysis and Synthesis*, 2nd Edition, Tata Mc Graw Hill, 2005. □ Van Valkenberg, M.E., *Network Analysis and Synthesis*, PHI learning, 2009.

BTEC304 Lab Analog Devices & Circuits

1. Study of Zener regulator as voltage regulator
2. Study of Half wave, full wave & Bridge rectifiers.
3. To plot the input and output characteristics of CE configuration.
4. To study the characteristics of a Class- A amplifier.
5. To study the characteristics of Class- B amplifier.
6. To study the characteristics of Class- B push-pull amplifier.
7. To study the characteristics of complementary symmetry amplifier.
8. To study the response of RC phase shift oscillator and determine frequency of oscillation.
9. To study the response of Hartley oscillator and determine frequency of oscillation.
10. To study the response of Colpitt's oscillator and determine frequency of oscillation.
11. To study the response of Wien Bridge oscillator and determine frequency of oscillation

BTEC-305 Lab Digital Circuit and Logic Design

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Realization Half Adder / Full Adder using Logic gates.
3. Realization Half Subtractor / Full Subtractor using Logic gates
4. Design 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter.
5. Design 4-Bit magnitude comparator using logic gates.Multiplexer: Truth-table verification and realization of Half adder and Full adder using MUX.
6. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using DEMUX.
7. Flip Flops: Truth-table verification of RS, JK , D, JK Master Slave Flip Flops.

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8. Design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
9. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.

BTCS 309 Object Oriented Programming Using C++ Lab

1. **[Classes and Objects]** Write a program that uses a class where the member functions are defined inside a class.
2. **[Classes and Objects]** Write a program that uses a class where the member functions are defined outside a class.
3. **[Classes and Objects]** Write a program to demonstrate the use of static data members.
4. **[Classes and Objects]** Write a program to demonstrate the use of const data members.
5. **[Constructors and Destructors]** Write a program to demonstrate the use of zero argument and parameterized constructors.
6. **[Constructors and Destructors]** Write a program to demonstrate the use of dynamic constructor.
7. **[Constructors and Destructors]** Write a program to demonstrate the use of explicit constructor.
8. **[Initializer Lists]** Write a program to demonstrate the use of initializer list.
9. **[Operator Overloading]** Write a program to demonstrate the overloading of increment and decrement operators.
10. **[Operator Overloading]** Write a program to demonstrate the overloading of binary arithmetic operators.
11. **[Operator Overloading]** Write a program to demonstrate the overloading of memory management operators.
12. **[Typecasting]** Write a program to demonstrate the typecasting of basic type to class type.
13. **[Typecasting]** Write a program to demonstrate the typecasting of class type to basic type.
14. **[Typecasting]** Write a program to demonstrate the typecasting of class type to class type.
15. **[Inheritance]** Write a program to demonstrate the multilevel inheritance.
16. **[Inheritance]** Write a program to demonstrate the multiple inheritance.
17. **[Inheritance]** Write a program to demonstrate the virtual derivation of a class.
18. **[Polymorphism]** Write a program to demonstrate the runtime polymorphism.
19. **[Exception Handling]** Write a program to demonstrate the exception handling.
20. **[Templates and Generic Programming]** Write a program to demonstrate the use of function template.
21. **[Templates and Generic Programming]** Write a program to demonstrate the use of class template.

22. **[File Handling]** Write a program to copy the contents of a file to another file byte by byte. The name of the source file and destination file should be taken as command-line arguments,

23. **[File Handling]** Write a program to demonstrate the reading and writing of mixed type of data.

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Fourth Semester

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BTEE 402 Linear Control Systems

Unit I Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems, Block diagrams, some illustrative examples.

Unit II Modeling: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Unit III Time Domain Analysis: Typical test - input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion.

Unit IV Root Locus Technique: The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot.

Unit V Frequency Domain Analysis: Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability. **Unit VI Compensation**: Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation.

Unit VII Control Components: Error detectors - potentiometers and synchros, servo motors, a.c. and d.c. techno generators, Magnetic amplifiers.

Suggested Readings / Books

- Dorf Richard C. and Bishop Robert H., *Modern Control System*, Addison -Wesley, Pearson New Delhi
- Ogata K., *Modern Control Engineering*l, Prentice Hall,
- Kuo B. C., *Automatic Control System*l, Prentice Hall
- Nagrath I.J. and Gopal M., *Control System Engineering*, Wiley Eastern Ltd.
- Singh / Janardhanan, Modern Control Engineering, Cengage Learning
- Kilian, Modern Control Technology: Components and Systems, Cengage Learning

BTEC 401 Analog Communication Systems

Unit I Base Band Signals and Systems: Introduction, Elements of communication system, Noise & its types; Noise figure & noise factor, Noise equivalent temperature. Modulation & Demodulation, Mixing; Linear & Nonlinear, need of modulation, types of modulation systems, basic transmission signals, Frequency multiplexing technique.

Unit II Analog Modulation Techniques: Introduction, theory of amplitude modulation; AM power calculations, AM current calculations, AM modulation with a complex wave, theory of frequency modulation;

mathematical analysis of FM, spectra of FM signals, narrow band of FM, Wide band FM, Theory of phase modulation, phase modulation obtained from frequency modulation, comparison of AM & FM. Comparison of PM & FM.

Unit III AM Transmission: Introduction, generation of Amplitude Modulation, Low level and high level modulation, basic principle of AM generation; square law modulation, Amplitude modulation in amplifier circuits, suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.

Unit IV AM Reception: Receiver Parameters; Selectivity, Sensitivity, Fidelity, Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver; Basic elements of AM super heterodyne Receiver; RF Amplifier, Neutralization of RF Amplifiers, Class of operation of RF Amplifiers, High power RF Amplifiers, Image Frequency Rejection, Cascade RF Amplifier, methods of increasing Bandwidth, frequency Conversion and Mixers; Additive Mixing, Bipolar Transistor Additive Mixer, self exicted Additive Mixers, multiplicative mixing, Multiplicative Mixer using dual gate MOSFET, Tracking & Alignment, IF Amplifier, AM detector: square law detector, Envelope or Diode detector, AM detector with AGC, Distortion in diode detectors, AM detector Circuit using Transistor, Double hetro-dyne receiver, AM receiver using a phase locked loop (PLL), AM receiver characteristics.

Unit V FM Transmission: FM allocation standards, generation of FM by direct method, varactor diode Modulator, Cross by Direct FM Transmitter, Phase-Locked-Loop Direct FM Transmitter, Indirect generation of FM; Armstrong method, RC phase shift method, Frequency stabilised reactance FM transmitter.

Unit VI FM Reception: Frequency demodulators, Tuned circuit frequency discriminators; Slope Detector, Balance Slope Detector, Foster Seeley discriminator, Ratio Detector, FM detection using PLL, Zero crossing detector as a Frequency Demodulator, quadrature FM demodulator, pre emphasis and de emphasis, limiter circuits, FM Capture effect, FM receiver, FM stereo transmission and reception, Two way FM Radio Transmitter and Receiver.

Unit VII SSB Transmission: Introduction, Single Side band systems, AM-SSB; Full carrier, Suppressed carrier , reduced carrier, Independent side band, and Vestigial side band, Comparison of SSB Transmission to conventional AM, Generation of SSB; Filter method, Phase Shift Method, Third Method.

Unit VIII SSB Reception: SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Single Side band receivers; Single side band BFO Receivers, Coherent Single side band BFO Receivers, Single Side band Envelop detection receiver, Multi Channel Pilot Carrier SSB Receiver.

Unit IX Pulse Modulation Transmissions and Reception: Introduction, Sampling Theorem Pulse Amplitude Modulation (PAM), Natural PAM Frequency Spectra for PAM , Flat-top PAM, Sample and hold circuits, Time division Multiplexing, PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM); Pulse Width Modulation(PWM), Pulse Position Modulation (PPM), PPM Demodulat

Suggested / Recommended Books:

- Electronic communication Systems by Kennedy & Davis, Tata Mcgraw Hill.
- Analog Communication Systems by Manoj Kumar & Manisha, Satya Prakashan, New Delhi, 2nd Edition.
- Electronic Communication System, Tomasi, Pearson Education.
- Electronic Communication, Roddy, Pearson Education.
- Analog Communication Systems by Symon Hykens, John Wiley & Sons .
- Principles of Communication System, Taub & Schilling, Tata Mc-Graw Hill.

BTEC402 Signals & Systems

Unit I **Classification of Signals and Systems:** Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic & aperiodic, random &deterministic signals, Even& Odd Signals, Energy & Power Signals, Description of continuous time and discrete time systems.

Unit II Analysis of Continuous Time Signals: Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and its properties in Signal Analysis, Power Spectral Density and Energy spectral density.

Unit III Linear Time Invariant -Continuous Time Systems: Linear Time invariant Systems and their properties. Differential equation & Block diagram representation, Impulse response, Convolution integral, Frequency response (Transfer Function), Fourier transforms analysis.

Unit IV Analysis of Discrete Time Signals: Sampling of CT signals and aliasing, DTFT and its properties, Z-transform and properties of Z-transform.

Unit **V Linear Time Invariant - Discrete Time System:** Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms.

Unit **VI Random Signal Theory:** Introduction to probabilities, Definition, probability of Random events, Joint and conditional probability, probability Mass function statistical averages. Probability density functions and statistical averages. Examples of P.D. function, transformation of random variables random processes, stationary, True averages and Ergodic.

Suggested Readings / Books:

- Signals and Systems by Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Pearson Education.
- Fundamentals of Signals and Systems by Edward W Kamen & Bonnie's Heck, Pearson Education.
- Communication Signals & System by Simon Haykins, John Wiley & Sons.
- Signals and Systems by H P Hsu, Rakesh Ranjan, Schaum's Outlines, Tata McGraw Hill.
- Digital Signal Processing by S Salivahanan, A. Vallavaraj, C. Gnanapriya, McGraw Hill International.
- Signals and Systems by Simon Haykins and Barry Van Veen, John Wiley & sons, Inc.
- Signal, System & Transforms, Phillips, Pearson Education.
- Roberts, Signals & Linear Systems, by Robert A. Gabel and Richard A., John Wiley.
- Signals & systems, by Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin. Pearson Education.

BTEC403 Electromagnetics & Antennas

Unit I **Electromagnetic Waves:** Maxwell's equations in differential and integral forms Wave equation and its solution in different media, polarization. Plane wave propagation in a dielectric medium, Reflection and transmission of an EM waves. Surface impedance, Poynting theorem.

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Unit II Waveguides and Transmission Lines: Waves between parallel planes. TE, TM and TEM Waves, velocities of propagation, Attenuation in parallel plane guides, wave impedance. Circuit representation of parallel plane transmission lines. Low loss transmission lines. Distortion less condition. Smith charts. Rectangular and circular wave guides. Wave impedance and characteristics impedances. Transmission line analogy for wave guides.

Unit III Antennas: introduction, concept of radiation in single wire, two wire, and dipole, Antenna parameters, Retarded potential, infinitesimal dipole. Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole.

Unit IV Antenna Arrays: Array of two point sources, Array factor, Array configurations, Hansen-woodyard end fire array, n-element linear array with uniform amplitude and spacing, n-element linear array with nonuniform spacing, Analysis of Binomial and Dolph-Tschebysceff array, Scanning Array, Super directive array. **Unit V Aperture Antennas:** Field Equivalence principle, Rectangular and circular aperture antennas, Horn antenna, Babinet's Principle, Slot Antenna, Reflector antenna.

Unit VI Wave Propagation: Free space equation; Reflection from earth's surface, Surface and Space wave propagation, Range of space wave propagation, Effective earth's radius, Duct propagation, Troposphere propagation. Structure of ionosphere, propagation of radio waves through ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

Suggested Readings / Books:

- Electromagnetics and radiating systems, Jordan E.C., PHI.
- Antenna Theory, Balanis C.A, John Wiley & sons.
- Antenna and wave propagation, R.L.Yadava, PHI
- Problem and solutions in electromagneics, W H Hayt and J A buck, Tata McGraw Hill
- Antenna Theory, Krauss J.D., McGraw Hill.
- Shen/Kong/Patnaik, Engineering Electromagnetics, Cengage Learning.

BTEC-404 Electronics Measurements and Instrumentation

Unit I Fundamentals: Generalized instrumentation system - Units and Standards, Calibration Methods, Standards of measurements, Classification of errors, error analysis. Static Characteristics- Accuracy, Precision sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effects etc. Dynamic Characteristics.

Unit II Electronic Meters: Electronic Analog voltmeter: DC voltmeters-Choppers type-DC amplifier, solid state voltmeter, Differential voltmeter, peak responding voltmeter, True RMS voltmeter, calibration of DC voltmeters. Digital Voltmeter:- Introduction, Ramp Techniques, dual slope, integrating type DVM, Successive approximation type DVM, Resolution and sensitivity of digital meters, general specification of a DVM. CRO's

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study of various stages in brief, measurement of voltage, current phase and frequency, special purpose oscilloscope.

Unit III Measuring Instruments: Principle of operation of galvanometer, PMMC, Moving Iron instruments, Resistance measurements using Wheatstone bridge, Kelvin Double Bridge, Ohm meter, AC bridges: Maxwell bridge, Maxwell wein bridge, Hey's Bridge, Schering Bridge, Anderson Bridge, Campbell Bridge.

Unit IV Instrumentation for Generation and Analysis of Waveforms: Signal generators: Fixed and variable AF oscillators, AF sine and square wave generator, Function generator: Square and pulse generator, Sweep generator, wave analyzer, harmonic distortion analyzer, spectrum analyzer, spectrum analysis.

Unit V Storage and Display Devices: Necessity of recorders, recording requirements, graphic recorders, strip chart recorders, magnetic tape recorders, digital tape recorders. Electronic indicating instruments, seven segment display, fourteen segmental display Nixie tube.

Unit VI Transducers and DATA Acquisition Systems: Strain gauge, LVDT, thermocouple, piezoelectric, crystal and photoelectric transducers and their applications. Data acquisition systems.

Unit VII Telemetry: Introduction, method of data transmission, types of telemetry systems and applications.

Suggested Readings / Books:

- Electrical and Electronic Measurements and Instrumentation, by K. SAWHNEY.
- Electronic Instrumentation and Measurement Techniques, by D Cooper.
- Electronic Instrumentation, by H.S. Kalsi, Tata McGraw Hill
- Applied Electronics Instrumentation and measurement, David Buchla, Wayne Melachlan:
- Electronics Measurement and Instrumentation,Oliver by B.H and Cag J.M. McGrawHill.
- Element of Electronic Instrumentation & Measurment, by Carr, Pearson Education.
- Electronic Measurments & Instrumentation, by Kishore, Pearson Education.
- Process Control Systems and Instrumentation, Bartelt, Cengage Learning

BTEC405 Pulse Wave Shaping and Switching

Unit I Introduction to Basic Elements and Waveforms: Passive and Active circuit elements, AC through inductor and capacitor, AC through Resistor-inductor and resistor-capacitor in series, Series and parallel resonance circuit, Different input signals, Average and RMS value.

Unit II Bistable Multivibrators: Role of feedback in electronic circuits, Fixed bias and self-bias bistable multivibrator, Speed-up Capacitors, unsymmetrical and symmetrical triggering, Application of Trigger input at the base of OFF Transistor, Application of Trigger input at the base of ON Transistor, Bisatble multivibrator as T Flip-Flop, Schmitt trigger circuit, Calculation of Upper Tripping Point and Lower Tripping Point.

Unit III Monostable and Astable Multivibrators: Collector Couple and Emitter Coupled Monostable multivibrator, Expression for Gate width, Astable Collector coupled and emitter coupled multivibrator, Complementary Transistor Astable multivibrator.

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Unit IV Switching Characteristics of Devices: Diode and transistor as electronic switch, Breakdown mechanism in diode, Effect of temperature on diode, Charge storage phenomena, Switching times in diode and transistor, Delay time, Rise time, Storage time and fall time, Use of Schotkey diode for reducing storage time.

Unit V Linear Wave Shaping: Low pass RC Network, Response to standard waveforms circuits, Integrator High Pass RC circuits, Response to standard waveforms, Differentiator, Double differentiation, Attenuator.

Unit VI NON- Linear Wave Shaping: Clipping circuits (diode & transistor), Diode comparators, Transistor differential comparator, Operational amplifier comparator, clamping circuits, Practical clamping circuit, clamping circuit theorem.

Suggested Readings / Books:

- Pulse and Digital Switching Circuits by Milliman, Taub; Tata Mcgraw Hill
- Pulse and Digital Circuits by Mothiki S. Prakash Rao; Tata Mcgraw Hill
- Pulse & Digital Circuits, by Rao K, Pearson Education.
- Switching Theory & Logic Design, by Rao , Pearson Education.
- Wave Generation and Shaping by Strauss McGraw Hill.
- Pulse and Switching Circuits by Sanjeev Kumar; Dhanpat Rai & Company

BTEC406 LAB Analog Communication Systems

Generation of DSB & DSB-SC AM signal using balanced modulator & determine modulation Index & detection of DSB using Diode detector.

- Generation of SSB AM signal & detection of SSB signal using product detector. □

To generate a FM Signal using Varactor & reactance modulation.

- Detection of FM Signal using PLL & foster seelay & resonant detector.
- To Study Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
- To study the circuit of PWM & PPM modulator & Demodulator
- Study of Frequency Division Multiplexing / Demultiplexing with sinusoidal & audio inputs Using DSBSC. □

Generation & study of Analog TDM at least 4 channels.

Sampling Theorem & Reconstruction of Signal from its samples using Natural Sampling, Flat Top Sampling & Sample & Hold Circuits & effect of duty cycle.

- To draw & study Polar plots & polarization of Helical, Ground plane, Yagiuda & dipole Antenna & calculate Antenna gain, Antenna beam width, Element current & Front-back ratio of antenna.
- To study Antenna matching using stubline.
- To study a transmission line attenuation & frequency characteristics.

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BTEC407 Electronic Measurement & Instrumentation

- Measurement of Inductance by Maxwell's Bridge.
- Measurement of small resistance by Kelvin's Bridge.
- Measurement of Capacitance by Schering Bridge.
- Measurement of Frequency by Wein Bridge.
- Measurement of medium resistance by Wheat Stone's Bridge.
- Determination of frequency & phase angle using C.R.O.
- To find the Q of a coil using LCR-Q meter.
- To determine output characteristic of a LVDT and determine its sensitivity.
- Study characteristics of temperature transducer like Thermocouple, Thermistor and RTD with implementation of small project using signal conditioning circuit.
- Study characteristics of Light transducer like Photovoltaic cell, Phototransistor and Pin Photodiode with implementation of small project using signal conditioning circuit.
- To study input- output characteristics of a potentiometer and to use two potentiometers as an error detector.
- To study transmitter- receiver characteristics of a synchro set to use the set as control component.
- To study the operation of a d-c positional servo system and to investigate the effect of damping and supply voltage on its response.
- To study the operation of an a.c. position servo-system and to obtain effects of supply voltage and system parameter on its transient response.
- To study a stepper motor and control its direction speed and number of steps with the help of a microprocessor.

BTEC408 Lab Signal & Systems Using MATLAB / MENTOR DSP

- Generation of continuous and Discrete Unit step signal.
- Generation of exponential and Ramp Signal in Continuous and Discrete Domain. □ Continuous and Discrete time Convolution.
- Adding and subtracting two Given Signals (Continues as well as Discrete Signals) □ To generate a random binary wave.
- To Generate a Random Sequences with arbitrary distribution, means and Variances for following: □ Rayleigh Distribution
- Uniform distribution
- Gaussian distribution.
- To Plot Probability density functions. Find Mean and Variance for the above distribution

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- To study Power Spectrum Density
- To study Difference Equation to develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
- To develop program modules based on operation on sequences like signal shifting, signal folding, signal addition and signal multiplication.
- To develop program for discrete convolution and correlation .
- To develop program for finding response of the LTI system described by the difference equation. □

To develop program for computing inverse Z-transform.

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Fifth Semester

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BTCS 304 Data Structures

PART-A

1. **Dynamic Memory Management:** Understanding pointers, usage of pointers, arithmetic on pointers, memory allocation, memory management functions and operators, debugging pointers - dangling pointers, memory leaks, etc. **[2]**
2. **Introduction:** Concept of data type, definition and brief description of various data structures, data structures versus data types, operations on data structures, algorithm complexity, Big O notation. [2]
3. **Arrays:** Linear and multi-dimensional arrays and their representation, operations on arrays, sparse matrices and their storage. [3]
4. **Linked List:** Linear linked list, operations on linear linked list, doubly linked list, operations on doubly linked list, application of linked lists. **[4]**
5. **Stacks:** Sequential and linked representations, operations on stacks, application of stacks such as parenthesis checker, evaluation of postfix expressions, conversion from infix to postfix representation, implementing recursive functions. **[4]**
6. **Queues:** Sequential representation of queue, linear queue, circular queue, operations on linear and circular queue, linked representation of a queue and operations on it, deque, priority queue, applications of queues. [4]

PART-B

7. **Trees:** Basic terminology, sequential and linked representations of trees, traversing a binary tree using recursive and non-recursive procedures, inserting a node, deleting a node, brief introduction to threaded binary trees, AVL trees and B-trees. **[4]**
8. **Heaps:** Representing a heap in memory, operations on heaps, application of heap in implementing priority queue and heap sort algorithm. **[2]**
9. **Graphs:** Basic terminology, representation of graphs (adjacency matrix, adjacency list), traversal of a graph (breadth-first search and depth-first search), and applications of graphs. **[3]**
10. **Hashing & Hash Tables:** Comparing direct address tables with hash tables, hash functions, concept of collision and its resolution using open addressing and separate chaining, double hashing, rehashing. **[3]**

Searching & Sorting: Searching an element using linear search and binary search techniques, Sorting arrays using bubble sort, selection sort, insertion sort, quick sort, merge sort, heap sort, shell sort and radix sort, complexities of searching & sorting algorithms. [5]

1. Sartaj Sahni, **Data Structures, Algorithms and Applications in C++,** Tata McGraw Hill.
2. Tenenbaum, Augenstein, & Langsam, **Data Structures using C and C++,** Prentice Hall of India.
3. R. S. Salaria, **Data Structures & Algorithms Using C++,** Khanna Book Publishing Co. (P) Ltd.
4. Seymour Lipschutz, **Data Structures**, Schaum's Outline Series, Tata McGraw Hill
5. Kruse, **Data Structures & Program Design**, Prentice Hall of India.
6. R. S. Salaria, **Test Your Skills in Data Structures**

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BTEC-501 DIGITAL COMMUNICATION SYSTEM

Internal Marks: 40 L T P

External Marks: 60 3 1 0

Total Marks: 100

UNIT I: - Elements of Digital Communication System:- Block diagram of Digital Communication system, Digital representation of Analog signals, Advantages and Disadvantages of Digital Communication system, Bandwidth -S/N trade off, Hartley Shannon Law, Sampling theorem . Concept of amount of Information and entropy, Shannon Fano Source Coding, Huffman source coding and Lampel-Ziv Source coding algorithm.

UNIT-II: - Pulse Code Modulation:- Sampling, Sampling Rate, Aliasing, quantization error, Uniform and Non uniform quantization, Dynamic Range, Coding efficiency, A law & μ law companding, Bandwidth of PCM, Block diagram of PCM system, Delta Modulation, Continuously variable Slope Delta Modulator (CVSDM) or Adaptive Delta Modulation, Differential Pulse Code Modulation, Intersymbol Interference, Eye Patterns, Signal power in binary digital signals.

UNIT-III Line Coding & Multiplexing Techniques: Line Coding & its properties. NRZ & RZ types, signaling format for unipolar, Polar, bipolar (AMI) & Manchester coding and their power spectra (No derivation), HDB and B8ZS signaling, Nyquist's criterions for pulse shaping, Fundamentals of time division multiplexing, Bit versus word interleaving, Statistical TDM, Codecs & Combo Chips. Basics of TDMA, FDMA and CDMA

UNIT-IV Digital Carrier Modulation & Demodulation Techniques: Introduction, Amplitude Shift Keying (ASK), ASK Spectrum, ASK Modulator, Coherent ASK Detector, Noncoherent ASK Detector, Frequency Shift Keying (FSK), FSK Bit Rate and Baud, Bandwidth and Frequency Spectrum of FSK, FSK Transmitter, Non-coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, Binary Phase Shift Keying, Binary PSK Spectrum, BPSK Transmitter, Coherent PSK Detection, Quadrature Phase Shift Keying (QPSK), QPSK Demodulator, Offset QPSK, $\pi/4$ QPSK, Comparison of conventional QPSK, Offset QPSK and $\pi/4$ QPSK, M-Ary BPSK, Quadrature Amplitude Modulation (QAM); MQAM transmitters and receivers, Band Width efficiency, Carrier Recovery; Squaring Loop & Costas Loop, Differential PSK, DBPSK transmitter and receiver, Constant Envelop Modulation; Minimum Shift Keying (MSK) & Gaussian Minimum Shift Keying (GMSK), matched filter receivers, bandwidth consideration and probability of error calculations for ASK, PSK, FSK schemes.

TEXT BOOK RECOMMENDED

1. Electronic Communication System Fundamentals through Advance Wayne Tomasi 5th 2009 Pearson Education.

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2. Communication Systems, Fourth Edition, Simon Haykin, Wiley publication.

BOOKS RECOMMENDED

1. Modern Electronic Communication, (6th edition), by Gary M. Miller, published by Prentice-Hall, 1999
2. Introduction to Communication Systems, third edition, by F. G. Stremler, AddisonWesley, 1990.
3. Digital Communication, E.A. Lee and D.G. Messerschmitt, , Kluwer Academic Publishers,1994
4. Digital Communication Receivers, H. Meyr, M. Moeneclaey, S.A. Fechtel, Wiley, 1998
5. Modulation and Coding Techniques in Wireless Communications by EVGENII KROUK, SERGEI SEMENOV, WILEY, 2011.

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BTEC-502 **DIGITAL SIGNAL PROCESSING**

Internal Marks: 40	L T P
External Marks: 60	4 1 0
Total Marks: 100	

UNIT I

Introduction: Limitations of analog signal processing, Advantages of digital signal processing and its applications; Some elementary discrete time sequences and systems; Basic elements of digital signal processing such as convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations. **DFT** and its properties; Linear Periodic and Circular convolution; Linear Filtering Methods based on DFT; Fast Fourier Transform algorithm using decimation in time and decimation frequency techniques; Goertzel algorithm.

UNIT II

The Z Transform: Introduction, Z-Transform, Region of convergence; Inverse Z Transform methods, properties of Z transform.

UNIT III

Design of Digital Filters: Structures of realization of discrete time system, direct form, Cascade form, parallel form and lattice structure of FIR and IIR systems. Linear Phase FIR filters; Design methods for FIR filters; IIR filter design by Impulse Invariance, Bilinear Transformation, Matched Z-Transformation, Analog and Digital Transformation in the Frequency Domain. Finite Precision Effects: Fixed point and Floating point representations, Effects of coefficient unitization, Effect of round off noise in digital filters, Limit cycles.

UNIT IV

DSP Processors: Architectures of ADSP and TMS series of processor.

RECOMMENDED TEXT BOOK

Digital Signal Processing Principles, Algorithms and Application John G Proakis, Dimtris G Manolakis 4th 2009.

Books Recommended

1. Discrete-Time Signal Processing Alan V Oppenheim, Ronald W Schafer, John R Back 2nd 2008, Prentice Hall.
2. Digital Signal Processing S. Salivahan, A Vallavaraj, Gnanpiya 1st 2008 Tata McGraw Hill.
3. Digital Signal Processing-A computer based approach S. K. Mitra 1st 2006 Tata McGraw Hill
4. Jervis, ―Digital Signal Processing‖, Pearson Education India.
5. Introduction to Digital Signal Processing Johny R.Johnson 1st 2006, Prentice Hall.

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BTEC-503 **LINEAR INTEGRATED CIRCUIT**

Internal Marks: 40 L T P

External Marks: 60 3 1 0

Total Marks: 100

UNIT I

DIFFERENTIAL AND CASCADE AMPLIFIERS: Introduction, Differential Amplifier, Differential Amplifier Circuit Configuration, Dual Input-Balanced output Differential Amplifier, Dual Input-Unbalanced output Differential Amplifier, Single Input-Balanced output Differential Amplifier, Single Input-unbalanced output Differential Amplifier with their DC and AC analysis, Differential Amplifier with swamping resistors, Constant current bias, Current Mirror, Cascaded differential Amplifier Stages, Level Translator, CE-CB configuration.

UNIT II

INTRODUCTION TO OPERATIONAL AMPLIFIERS: Block diagram of a typical Op-Amp, Schematic symbol, integrated circuits and their types, IC package types, Pin Identification and temperature range, Interpretation of data sheets, Overview of typical set of data sheets, Characteristics and performance parameters of and Op-Amp, Ideal Op-Amp, Equivalent circuit of an Op-Amp, Ideal voltage transfer curve, Open loop configurations : Differential, Inverting & Non Inverting. Practical Op-Amp: Input offset voltage, Input bias current, Input offset current, total output offset voltage, Thermal drift, Effcet of variation in power supply voltages on offset voltage, Change in Input offset voltage and Input offset current with time, Temperature and supply voltage sensitive parameters, Noise, Common Mode configuration and common mode rejection Ratio. Feedback configurations.

UNIT III

APLICATIONS OF OP-AMP: DC and AC amplifiers, Peaking Amp, Summing, Scaling and Averaging Amp, Instrumentation Amplifier, V to I and I and to V converter, Log and Antilog Amp, Integrator, Differentiator. Active filters: First order LP Butterworth filter, Second order LP Butterworth filter, First order HP Butterworth filter, Second order HP Butterworth filter, Higher order filters, Band pass filter, Band reject filters, All pass filter, Phase shift oscillator, Wein bridge oscillator, Quadrature oscillator, Square wave generator, Triangular wave generator, Sawtooth wave generator, Voltage controlled oscillator, Basic comparator, Zero crossing detector, Schmitt trigger, window detector, V to F and F to V converters, A to D and D to A converters, Peak Detector, Sample and Hold Circuit.

UNIT IV

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SPECIALIZED IC APPLICATIONS: IC 555 Timer: Pin configuration, Block diagram, application of IC 555 as Monostable and Astable Multivibrator., Phase Lock Loops: Operating principles & applications of IC 565, Voltage Regulators: Fixed voltage regulators, Adjustable voltage regulators, Switching Regulators.

Recommended Text Book:

1. Op Amps & Linear Integrated circuits by Ramakant Gayakwad.

Recommended Reference Books

1. Op Amps & Linear Integrated circuits by Coughlin

2. Op Amps & Linear Integrated circuits by RaviRaj Dudeja.

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BTEC-504 **MICROPROCESSORS & MICROCONTROLLERS**

Internal Marks: 40	L T P
External Marks: 60	4 1 0
Total Marks: 100	

Unit I

INTRODUCTION TO 8085 MICROPROCESSOR: History and evolution of Microprocessors, 8085 Microprocessor, Memory Interfacing, Memory mapped I/O and peripheral mapped I/O 8085 Microprocessor Programming model. Introduction to 8085 instructions, programming techniques, counters and time delays, stack and subroutines, interrupts.

Unit II

8051 MICROCONTROLLER: Comparison of Microprocessor and Microcontroller, micro controller and embedded processors, Architecture and pin configuration of 8051

Unit III

8051 ASSEMBLY LANGUAGE PROGRAMMING: Introduction to 8051 Assembly programming, Data Types and directives, 8051 flag bits and PSW register. Register banks and stack. Jump loop and call instructions, I/O Port programming: Addressing modes and accessing memory using various addressing modes. Arithmetic instructions and programs, Logic instructions and programs, Single bit instructions and programming, Timer/counter programming in the 8051.

Unit IV

SERIAL COMMUNICATION: 8051 connection to RS 232, 8051 serial communication programming, interfacing of 8051microcontroller: LCD, ADC and DAC, Stepper motor.

Recommended Text Books:-

1. Microprocessor Architecture, Programming and application with 8085 by Gaonkar
2. The 8051 Microcontroller and embedded Systems by: - Ali Mazidi, Pearson Education
3. The 8051 Microcontroller by K. J. Ayala, Cengage Learning.

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BTEC-505 **LAB DIGITAL SIGNAL PROCESSING**

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

List Of Experiments:

Perform the following exercises using MATLAB

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
2. Write a program in MATLAB to generate standard sequences.
3. Write a program in MATLAB to compute power density spectrum of a sequence.
4. To develop program modules based on operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.
5. Write a program in MATLAB to verify linear convolution.
6. Write a program in MATLAB to verify the circular convolution.
7. To develop program for finding magnitude and phase response of LTI system Described by system function H(z).
8. To develop program for finding response of the LTI system described by the difference equation.
9. To develop program for computing inverse Z-transform.
10. To develop program for computing DFT and IDFT.
11. To develop program for conversion of direct form realization to cascade form realization.
12. To develop program for cascade realization of IIR and FIR filters.
13. To develop program for designing FIR filter.
14. To develop program for designing IIR filter.
15. To write a MATLAB program for noise reduction using correlation and autocorrelation methods.
16. To write a MATLAB programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.
17. Write a program in MATLAB to find frequency response of different types of analog filters.
18. Write a program in MATLAB to design FIR filter (LP/HP) through Window technique
    a. Using rectangular window
    b. Using triangular window

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BTEC-506 **LAB LINEAR INTEGRATED CIRUIT**

Internal Marks: 30
External Marks: 20

Total Marks: 50

L T P

0 0 2

List Of Experiments:

1. To study differential amplifier configurations.
2. To measure the performance parameters of an Op amp.
3. Application of Op amp as Inverting and Non Inverting amplifier.
4. To study frequency response of an Op Amp
5. To use the Op-Amp as summing, scaling & averaging amplifier.
6. To use the Op-Amp as Instrumentation amplifier
7. Design differentiator and Integrator using Op-Amp.
8. Application of Op Amp as Log and Antilog amplifier. Design Low pass, High pass and Band pass 1st order butterworth active filters using Op Amp.
9. Design Phase shift oscillator using Op-Amp.
10. Design Wein Bridge oscillator using Op-Amp.
11. Application of Op Amp as Sawtooth wave generator.
12. Application of Op Amp as Zero Crossing detector and window detector.
13. Application of Op Amp as Schmitt Trigger.
14. Design a series regulators with an error amplifier to provide an output voltage of 5 volt at a load current of 1.5 Amp. Use a 741 Op-Amp and specify the Zener voltage necessary transistor gain and the maximum power dissipation of the transistor.
15. Design a delay circuit using 555.
16. To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL.
17. Verification of hardware results obtained using SPICE.

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BTEC-507 **Lab-Digital Communication System**

Internal Marks: 30
External Marks: 20

L T P
0 0 2

Total Marks: 50

LIST OF EXPERIMENTS

1. Study of Time Division Multiplexing system.
2. Study of pulse code modulation and demodulation.
3. Study of delta modulation and demodulation and observe effect of slope overload.
4. Study pulse data coding techniques for various formats.
5. Data decoding techniques for various formats.
6. Study of amplitude shift keying modulator and demodulator.
7. Study of frequency shift keying modulator and demodulator.
8. Study of phase shift keying modulator and demodulator.
9. Error Detection & Correction using Hamming Code
10. Digital link simulation; error introduction & error estimation in a digital link using MATLAB (SIMULINK)/ communication simulation packages.

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BTEC-508 **Lab Hardware Programme & Interfacing**

Internal Marks: 30
External Marks: 20

L T P
0 0 2

Total Marks: 50

LIST OF EXPERIMENTS

Note: Any Eight Experiments each from Part A and Part-B Part-A: List of Experiments using 8085/8086:

1. Study of 8085 and 8086 Microprocessor Kits.
2. Write a program to add two 8-bit number using 8085.
3. Write a program to add two 16-bit number using 8085.
4. Write a program to subtract two 8-bit number using 8085.
5. Write a program to subtract two 16-bit number using 8085.
6. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
7. Write a program to sort series using bubble sort algorithm using 8085.
8. Write a program to copy 12 bytes of data from source to destination using 8086.
9. Write a program to find maximum and minimum from series using 8086.
10. Write a program to control the operation of stepper motor using 8085/8086 microprocessors and 8255 PPI.
11. Write a program to control speed of DC motor using 8085/8086 microprocessors and 8255 PPI.

Part-B: List of Experiments using 8051:

1. Study of 8051/8031 Micro controller kits.
2. Write a program to add two numbers lying at two memory locations and display the result.
3. Write a program for multiplication of two numbers lying at memory location and display the result.
4. Write a Program to arrange 10 numbers stored in memory location in Ascending and Descending order.
5. Write a program to show the use of INT0 and INT1.
6. Write a program of Flashing LED connected to port 1 of the Micro Controller
7. Write a program to generate a Ramp waveform using DAC with micro controller.
8. Write a program to interface the ADC.
9. Write a program to control a stepper motor in direction, speed and number of steps.
10. Write a program to control the speed of DC motor.
11. Interfacing of high power devices to Micro-controller port-lines, LED, relays and LCD display.

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Sixth Semester

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BTCS 401 **OPERATING SYSTEMS**

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

PART-A

1. Introduction to Operating system, Role of Operating System as resource manager, function of kernel and shell, operating system structures, views of an operating system.

2. Process management: CPU scheduling, Scheduling Algorithms, PCB, Process synchronization, Deadlocks, Prevention, Detection and Recovery.

3. Memory Management: Overlays, Memory management policies, Fragmentation and its types, Partitioned memory managements, Paging, Segmentation, Need of Virtual memories, Page replacement Algorithms, Concept of Thrashing.

PART-B

4. Device Management: I/O system and secondary storage structure, Device management policies, Role of I/O traffic controller, scheduler.

5. File Management: File System Architecture, Layered Architecture, Physical and Logical File Systems, Protection and Security.

6. Brief study to multiprocessor and distributed operating systems.

7. Case Studies: LINUX / UNIX Operating System and Windows based operating systems.

Suggested Readings/ Books:

1. A Silberschatz and Peter B. Galvin, —Operating System Concepts" Addisonl Wesley Publishing Company
2. Dhamdhere, —Systems Programming & Operating Systemsl Tata McGraw Hill
3. Gary Nutt, —Operating Systems Conceptsl, Pearson Education Ltd. 3rd Edition
4. Operating System by Madnick Donovan
5. Operating System by Stallings

BTEC-601 MICROWAVE AND RADAR ENGINEERING

Internal Marks: 40 **L T P**
External Marks: 60 **4 1 0**
Total Marks: 100

Microwave Tubes: Limitations of conventional tubes, construction, operation and properties of Klystron Amplifier, reflex Klystron, Magnetron, Travelling Wave Tube (TWT), Backward Wave Oscillator (BWO), Crossed field amplifiers.

Microwave Solid State Devices: Limitation of conventional solid state devices at Microwaves, Transistors (Bipolar, FET), Diodes (Tunnel, Varactor, PIN), Transferred Electron Devices (Gunn diode), Avalanche transit time effect (IMPATT, TRAPATT, SBD), Microwave Amplification by Stimulated Emission of Radiation (MASER).

Microwave Components: Analysis of Microwave components using s-parameters, Junctions (E, H, Hybrid), Directional coupler, Bends and Corners, Microwave posts, S.S. tuners, Attenuators, Phase shifter, Ferrite devices (Isolator, Circulator, Gyrator), Cavity resonator, Matched termination.

Microwave Measurements: Power measurements using calorimeters and bolometers, Measurement of Standing Wave Ratio (SWR), Frequency and wavelength, Microwave bridges.

Introduction to Radar Systems: Basic Principle: Block diagram and operation of Radar, Radar range Equation, Pulse Repetition Frequency (PRF) and Range Ambiguities, Applications of Radar.

Doppler Radars: Doppler determination of velocity, Continuous Wave (CW) radar and its limitations, Frequency Modulated Continuous Wave (FMCW) radar, Basic principle and operation of Moving Target Indicator (MTI) radar, Delay line cancellers, Blind speeds and staggered PRFs. **Scanning and Tracking Techniques:** Various scanning techniques (Horizontal, vertical, spiral, palmer, raster, nodding), Angle tracking systems (Lobe switching, conical scan, monopulse), Range tracking systems, Doppler (velocity) tracking systems.

Text books:

1. Microwave devices and circuits: Samuel Liao; PHI
2. Microwave devices and Radar Engg: M. Kulkarni; Umesh Publications
3. Introduction to radar systems: Merill I. Skolnik

Reference Books:

1. Foundation of Microwave Engg. : R.E. Collin; McGraw Hill
2. Microwave Engg: K.C Gupta

BTEC-602 **WIRELESS COMMUNICATION SYSTEM**

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Introduction: A basic cellular system, performance criteria, operation of cellular systems, planning a cellular system, analog & digital cellular systems. Examples of Wireless Communication Systems: Paging Systems, Cordless Telephone Systems, Cellular Telephone Systems. Blue tooth and Zig Bee.

Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems.

Digital Communication through fading multipath channels: Fading channel and their characteristics- Channel modeling, Digital signaling over a frequency non selective slowly fading channel. Concept of diversity branches and signal paths. Combining methods: Selective diversity combining, Switched combining, maximal ratio combining, Equal gain combining.

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access, Packet Radio Protocols; Pure ALOHA, Slotted ALLOHA.

Wireless Systems & Standards: AMPS and ETACS, United states digital cellular (IS- 54 & IS 136), Global system for Mobile (GSM): Services, Features, System Architecture, and Channel Types, Frame Structure for GSM, Speech Processing in GSM, GPRS/EDGE specifications and features. 3G systems: UMTS & CDMA 2000 standards and specifications. CDMA Digital standard (IS 95): Frequency and Channel specifications, Forward CDMA Channel, Reverse CDMA Channel, Wireless Cable Television.

Future trends: 4G mobile techniques, LTE-Advance systems

Recommended Text Books:

1. T.S.Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education Asia, 2010.
2. William C Y Lee, Mobile Cellular Telecommunications, 2nd Edition, MGH, 2004.
3. Raj Pandya, —Mobile and Personal Communication systems and services‖, Prentice Hall of India, 2001.
4. Wireless and Digital Communications; Dr. Kamilo Feher (PHI)

BTEC-603 ENGINEERING ECONOMICS & INDUSTRIAL MANAGEMENT

External Marks: 60	**L**	**T**	**P**
Internal Marks: 40	**3**	**1**	**0**
Total Marks: 100			

Cost analysis: Break-even analysis, two and three alternatives, graphical solution. Breakeven charts, effects of changes in fixed and variable costs. Minimum cost analysis, economics order quality. Effect of risk and uncertainty on lot size.

Replacement Studies: Reasons for replacement, factors to be considered in replacement Studies, discounted cash flow analysis, economic life of a project, challenger and defender.

Economic Analysis Of Investment Alternatives : Basic economy study patterns and their comparison, decision making in selection of alternative by present worth methods, rate of return method, payout period method and uniform annual cost method, economic analysis of new projects, effect of taxation on economic studies.

Cost Estimation : Difference between cost estimation and cost accounting, qualifications of an estimator. Estimating procedure, Estimate of material cost and labour cost. Estimation of cost in various manufacturing operations.

Depreciation : Types of depreciation and their Methods.

Concepts of Industrial Management: Concept, Development, application and scope of Industrial Management , Functions of Management, Evolution of Management Thought : Taylor's Scientific Management, Fayol's,Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne, Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs'

Productivity : Definition, measurement, productivity index, types of production system, Industrial Ownership.

Designing Organizational Structures: Concept, Importance and characteristics of organization, Types of organization - Project, matrix and informal organization. Span of control, Delegation of authority.

Materials Management-Objectives, Inventory - functions, types, associated costs, Inventory Control Systems-Continuous review system-periodical review system. Stores Management and Stores Records. Purchase management, duties of purchase of manager, associated forms.

TEXT BOOKS

1. O.P Khanna, Industrial Engineering.
2. T.N. Bhagooiwal Economics of Labour and Industrial Relations (Sahitya BhawanAgra)
3. Engineering Economy : Thuesen Prentice Hall

REFERENCES

1. Minappa and Personnel Managements M.S. Saiyada (Tata Mc Graw Hill)
2. C.B. Mamoria Personnel Management (Himalaya publishing house Bombay)
3. Engg. Economics Analysis Bullinger
4. Introduction to Econometrics : Kliwen Prentice Hall

BTEC-604 **VLSI DESIGN**

Internal Marks: 40	**L**	**T**	**P**
External Marks: 60	**4**	**1**	**0**
Total Marks: 100			

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, and Logical operators. Types of delays, Entity and Architecture declaration Introduction to behavioral, dataflow and structural models

VHDL Statements: Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Array and Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.

Applications of VHDL: Combinational Circuit Design such as such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters etc.

Review of MOS Devices: MOS Structure, Enhancement & Depletion Transistor, Threshold Voltage, MOS device design equations MOS Transistor Models. NMOS, PMOS, CMOS.

Basic Electrical Properties and Circuit Concepts: The NMOS Inverter and Transfer Characteristics pull up and pull down ratios of NMOS, alternative forms of pull up the CMOS Inverter and transfer characteristics. CMOS Inverter Delays. Driving large Capacitive loads, Propagation delays and effect of wiring capacitance.

Circuit Characterization and Performance Estimation: Estimation of R, C, L, Switching Characteristics-delay models. Power dissipation. Scaling of MOS circuits. Effect of device scaling on circuit performance.

Recommended Text Books:

1. ―*A VHDL Primmer*‖: Bhasker; Prentice Hall 1995.
2. Weste and Eshrighian, ―*Principle of CMOS VLSI Design*‖ Pearson Education, 2001.
3. Pucknell D A and Eshraghian K, ―*Basic VLSI Design*‖, Prentice Hall India, New Delhi (2003).
4. *Fundamentals of Digital Logic with VHDL Design*: Brown and Vranesic; TMH(2000)
5. S. M. Kang, Y. Lebiebici, ―*CMOS digital integrated circuits analysis & design*‖ TMH, 3rd Edition.

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BTEC-605 **LAB VLSI**

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50
List of Experiments:
Combinational Design Exercises

1. Design of basic Gates: AND, OR, NOT.

2. Design of universal gates

3. Design of 2:1 Mux using other basic gates

4. Design of 2 to 4 Decoder

5. Design of Half-Adder, Full Adder, Half Substractor, Full Substractor

6. Design of 3:8 Decoder

7. Design of 8:3 Priority Encoder

8. Design of 4 Bit Binary to Grey code Converter

9. Design of 4 Bit Binary to BCD Converter using sequential statement

10. Design an 8 Bit parity generator (with for loop and Generic statements)

11. Design of 2,s Complementary for 8-bit Binary number using Generate statements

Sequential Design Exercises

12. Design of all type of Flip-Flops using (if-then-else) Sequential Constructs

13. Design of 8-Bit Shift Register with shift Right, Rhisft Left, Load and Synchronous reset.

14. Design of Synchronous 8-bit Johnson Counter.

15. Design of Synchronous 8-Bit universal shift register (parallel-in, parallel-out) with 3- state output (IC 74299)

16. Design of 4 Bit Binary to BCD Converter using sequential statement.

17. Design counters (MOD 3, MOD 5, MOD 8, MOD 16)

18. Design a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.

19. Design 3-line to 8-line decoder with address latch

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BTEC-606 LAB MICROWAVE ENGINEERING

Internal Marks: 30
External Marks: 20
Total Marks: 50

L	T	P
0	0	2

List of Experiments:

1. Study of microwave components and instruments.
2. Measurement of crystal characteristics and proof of the square law characteristics of the diode.
3. Measurement of klystron characteristics.
4. Measurement of VSWR and standing wave ratio.
5. Measurement of Dielectric constants.
6. Measurement of Directivity and coupling coefficient of a directional coupler.
7. Measurement of Q of a cavity.
8. Calibration of the attenuation constant of an attenuator.
9. Determination of the radiation characteristics and gain of an antenna.
10. Determination of the phase-shift of a phase shifter.
11. Determination of the standing wave pattern on a transmission line and finding the length and position of the short circuited stub.

BTEC 901 **RELATIONAL DATABASE MANAGEMENT SYSTEM**

Internal Marks: 40 **L T P**

External Marks: 60 **3 1 0**

Total Marks: 100

Introduction to Database Systems:

File Systems Versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, Database System Architecture, DBMS Layers, Data independence.

Physical Data organization: File Organization and Indexing, Index Data Structures, Hashing, B-trees, Clustered Index, Sparse Index, Dense Index, Fixed length and Variable length Records.

Data Models: Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with ER Model, Comparison of Models.

The Relational Model: Introduction to the Relational Model, ER to Relational Model Conversion, Integrity Constraints over Relations, Enforcing Integrity Constraints, Relational Algebra, Relational Calculus. querying Relational Data.

Relational Query Languages: SQL: Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL algebraic Operations, Nested Queries, Aggregate Operations, Cursors, Dynamic SQL, Integrity Constraints in SQL,Triggers and Active Database, Relational Completeness, Basic query Optimization Strategies. Algebric Manipulation and Equivalences.[

Database Design: Functional Dependencies, Reasoning about Functional Dependencies, Normal Forms, Schema Refinement, First, Second and Third Normal Forms, BCNF, Multi-valued Dependency, Join Dependency, Fourth and Fifth Normal Forms, Domain Key Normal Forms, Decompositions.

Transaction Management:

ACID properties, Serializability, Two-phase Commit protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read problem , Read-Write Locks, Deadlocks Handlins. 2pL protocol.

Database Protection:

Threats, Access Control Mechanisms, Discretionary Access Control, Grant and Revoke, Mandatory Access Control, Bell laPadula Model, Role Based Security, Firewalls, Encryption and Digiral Signatures.

Suggested ReadingvBooks:

1. Ramez Elmasri, Shamkant Navathe ,Fundamentals of Database Systems, Fifth Edition, pearson education, 2007.

2. C.J. Date , An Introduction to Database Systems, Eighth Edition, Pearson Education

3. Alexis leon, Mathews Leon , Database Management Systems, Leon Press.

4. S. K. Singh, Database Systems Concepts, Design and Applications, Pearson Educaton.

BTEC 902 **MICRO ELECTRONICS**

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 1 0

INTRODUCTION: Advantages of IC's, General classification of IC's(Linear/Digital IC's ,Monolithic/ Hybrid IC's), Basic IC fabrication steps.

CRYSTAL GRTOWTH AND EPITAXY: Starting material for formation of crystal, Horizontal Bridgeman Method, Czochralski growth, Distribution of dopants, Zone refining, Silicon Float Zone process, Si-Wafer preparation, Epitaxial growth, Techniques used for epitaxial growth(LPE,VPE,MBE)

SILICON OXIDATION: Thermal oxidation process (Kinetics of growth , Thin oxide growth), Effect of impurities on the oxidation rate, Preoxidation Cleaning, Various oxidation techniques, Masking properties of SiO2 , IV PHOTOLITHOGRAPHY AND ETCHING, Pattern generation/Mask making, Contact and Proximity printing, Photoresistsl, Photolithography Process(Lift off technology , Fine line photolithography), Wet/Dry etching, Reactive Plasma etching techniques and applications

DIFFUSION AND ION IMPLANTATION: Basic diffusion process(Diffusion equation, Diffusion profiles), Extrinsic diffusion, Lateral Diffusion, Ion Implantation Process (Ion distribution , Ion Stopping), Implant Damage and Annealing process (Furnace and RTA), VI IC PACKAGING, Isolation Techniques, Testing of the Chip, Wire Bonding techniques, Flip Chip technique, Various Packaging methods and Materials, VII FABRICATION OF MONOLITHIC COMPONENTS, Fabrication of Diodes, Resistors, capacitors and inductors, Fabrication of BJT and FET, Fabrication of MOS Devices , CMOS fabrication techniques(nwell and p-well process sequences), Introduction to MEMS.

Recommended Text Books:

1. Fundamental of Semiconductor Fabrication:Gray S.May and Simon M.Sze
2. VLSI Technology : Sze.

Reference Books:

1. Microelectronics: Jacob and Millman

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BTEC 903 **INDUSTRIAL ELECTRONICS**

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Characteristics of Selected Devices: Fast recovery diodes, Schottky diode, SCR, gate trigger and commutation circuits, series and parallel connection of SCRs, Diac, Triac, UJT, Power MOSFETs.

Controlled Rectifier: Half wave and full wave with resistive & R-L-E and resistive-inductive loads. Free-wheeling diode, three phase rectifiers, Bridge rectifiers -half controlled and fully controlled.

Inverter, Chopper and Cyclo converter: Voltage driven, current driven, bridge, parallel, SCR versions, control of output voltage-PWM schemes, harmonic reduction

Motor Control: D.C. and A.C. motor control, reversible drives, closed loop control, commutator less D.C. motor control.

A.C. Voltage Controllers: Types of AC Voltage Controllers, Integral cycle control, single phase voltage controller, Sequence control of AC voltage (Transformer tap changers)

Books Recommended:

1. Power Electronics - P.C. Sen, Tata McGraw Hill Publishing Co., Ltd., 1987.
2. Power Electronics and Control - S.K. Dutta, Prentice Hall of India Pvt. Ltd., 1986.

BTEC 904 **DIGITAL SYSTEM DESIGN**

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
4	1	0

Combinational Logic: Review of adders, Subtractor, Multipliers, Multiplexers, ROM, PLA, PAL and PLD.

Synchronous Sequential Logic: Flip-flops, Triggering of flip-flops, Analysis of clocked sequential circuits, State reduction and assignment, Flip-flop excitation tables, Design procedure, Design of counters,

Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modeling and Simulation of Moore and Mealy machines.

Algorithmic State Machines: ASM chart, Timing considerations, Control implementation, Control Design with multiplexers, PLAs, etc.

Asynchronous Sequential Logic: Analysis Procedure, Circuits with latches, Design procedure, Reduction of state and flow tables, Race-free state assignment, Hazards, Design examples.

Designing with Programmable Logic Devices and Programmable Gate Arrays: Read only memories, Programmable logic arrays, Programmable array logic, Designing with FPGAs, Xilinx series FPGAs

TEXT BOOKS:

1. VHDL - 3rd Edition - Douglas Perry - TMH
2. Fundamentals of Digital Logic with VHDL design - Stephen Brown, Zvonko Vranesic - TMH.
3. Digital Design Principles - William I Fletcher.

REFERENCE BOOKS:

1. Digital System Design Using VHDL - Chales H. Roth.
2. Digital System Design - John Wakerley.
3. VHDL - Zainalabedin Navabbi.
4. VHDL - D. Smith.

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BTEC-905 INTELLECTUAL PROPERTY RIGHTS AND PATENT SYSTEMS

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
4	1	0

Basic of intellectual property Rights

Introduction, Justification and Classification of intellectual property Rights, Classification of Treaties relating to intellectual property Rights, Stranded setting treaties, Global protection system treaties, and Classification treats.

Patent System

History of the patent system, Patent on genetic resources, patents on chemicals, designs, patent based on software, business methods, internet patent, Exception to exclusive rights conferred to a patent holder, Remember for infringement of a patent.

Copyrights and related rights

Nature and scope of protection of copyrights and related rights, Protection of copyrights in the digital media. Defense of fair use, Moral rights of the author, Copyrights societies, Remedies for infringement of Copyrights.

Design rights

Nature and scope of protection of design rights, protection of layout designs (topographies) of integrated circuits, protection of undisclosed information, protection of trademarks, domain names and geographical indications.

Practical aspects of a patent

Drafting of a patent, Few Exercises on the preliminary rules on preparing an application seeking a patent.

Recommended Text Books:

1. Cornish W.R., Intellectual property: patents, copyright, trademarks and allied rights, sweet and Maxwell 2007.

2. P. Narayana, Intellectual property law, eastern law house 2nd ed., 2001.

3. Robin Jacob and Daniel Alexander, a guide book to Intellectual property patent trademarks, Copy rights and design, sweet and Maxwell 4th ed., 1993.

BTEC-906 INTELLIGENT INSTRUMENTATION

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
4	1	0

INSTRUMENTATION

Introduction about Instrumentation systems, Types of Instrumentation systems, Data acquisition system (DAS) and its uses in intelligent Instrumentation system, Detailed study of each block involved in making of DAS, Signal Conditioners: as DA, IA, Signal Converters (ADC & DAC), Sample and hold, Designing of Pressure, Temperature measuring instrumentation system using DAS, Data logger.

AUTOMATION

Introduction about Automation system, Concepts of Control Schemes, Types of Controllers, Components involved in implementation of Automation system i.e., DAS, DOS, Converter (I to P) and Actuators: Pneumatic cylinder, Relay, Solenoid (Final Control Element), Computer Supervisory Control System (SCADA), Direct Digital Control's Structure and Software.

PLC

Introduction of Programmable logic controller, Principles of operation, Architecture of Programmable controllers, Programming the Programmable controller.

INTELLIGENT CONTROLLER

Introduction to Intelligent Controllers, Model based controllers, Predictive control, Artificial Intelligent Based Systems, Experts Controller, Fuzzy Logic System and Controller, Artificial Neural Networks, Neuro-Fuzzy Controller system.

Reference Text Books:

1. —Process Control Instrumentation Technology‖ 6/e, by Curtis D Johnson, Pearson Ed.

2. —Electrical and Electronics Measurement and Instrumentation‖ by A. K. Swahney.

3. —Electronics instrumentation‖ by H. S. Kalsi [TMH]

4. —Computer-Based Industrial Control‖, by Krishna Kant, PHI.

5. —Process Control Instrumentation Technology‖, by Curtis D Johnson, Pearson Ed

BTEC 907 **INFORMATION THEORY & CODING**

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
4	1	0

Basic Concepts of Information Theory : The concept of Amount of Information, Average Information, Entropy, Information rate, Shannon's Theorem, Mutual information; Channel capacity; BSC and other channels, Capacity of a Gaussian Channel, Bandwidth - S/N Trade-off, Introduction to Channel Capacity & Coding, Channel Models, Channel Capacity Theorem, Shannon Limit. Huffman source coding algorithm, Lempel Ziv source coding algorithm.

Introduction to Error Control Coding:

Linear Block Codes: Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code.

Cyclic Codes: Description of Cyclic codes, Generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes.

BCH Codes: Description of codes, Decoding of BCH codes, Implementation of error connection.

Convolution Codes: Encoding of convolution codes, structural properties of Convolution codes, Distance Properties of convolution codes.

Automatic Repeat Request Strategies: Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

Recommended Books:

1. F.M Reza: Information Theory, Mc Graw Hill
2. ShuLin & J Costeib: Error Control Coding, PHI
3. Dass, Mullick & Chatterjee: Digital Communication, John Wiley, Ed. 1992
4. Information Theory and Reliable Communication: Robert G. Gallanger Mc Graw Hill, 1992
5. Related IEEE/IEE publications

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BTIT 702 **SOFTWARE PROJECT MANAGEMENT**

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

1. The software Engineering Problem

The software engineering problem and software products, All of the software engineering activities, The concept of software product like cycle model

2. Software evolution

The concept of a software like cycle, The various forms of a software product form initial conception through development and operation to retirement, Controlling activities and disciplines to support evolution, Planned and unplanned events that affect software evolution, The role changing technology.

3. Technical Communication

Fundamentals of technical communication Oral and Written communications, preparing oral presentation and supporting material, Software project documentation of all kinds, ISO/Other, e.g. IEEE .

4. Software Configuration management

Concept of configuration management, Its role in controlling software evolution, Maintaining Product integrity, Changing control and version control, Organization structure for configuration

5. Software Quality Assurance

Software quality assurance as a controlling discipline, Organizational structures for quality assurance, Independent verification and validation teams, Test and evaluation teams , Software technical reviews , Software quality assurance plans : ISO 9000, ANSI/IEEE

6. Standards

Introduction to standards - ISO 9002 and ISO 9003 - Quality system development, SO 9000 standard for software, Understanding ISO 900-3 clauses, SEI model - capability Maturity model - Five levels Bootstrap method, Implementing ISO 9000, Analysis the Quality system, Documenting & Auditing quality system, ISO 9000 registration process & Accreditation System, Total Quality Management

7. Software Project organizational and management issues

Staffing - development, organizations, quality assurance teams , project planning - choice of process model, project scheduling and milestones, resource allocation

8. Software project economics

Cost estimation, risk analysis for software projects, factors that affect cost.

REFERENCES

1. S/W Engineering - Somerville (Addison Wesley) .
2. S/W Engineering-Pressmen.
3. S/W Engineering -Jalota

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Seventh/ Eighth Semester

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BTCS-403 Computer Networks

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

UNIT 1. Introduction to Computer Networks:
Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and wired networks, broadcast and point to point networks, Network topologies, Network software: concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP reference model.

Unit 2. Physical Layer:
Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Data rate limits : Nyquist formula, Shannon Formula, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching ,Packet Switching & their comparisons.

Unit 3. Data Link Layer:
Design issues, Framing, Error detection and correction codes: checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP.

Unit 4. Medium Access Sub-Layer:
Static and dynamic channel allocation, Random Access: ALOHA, CSMA protocols, Controlled Access: Polling, Token Passing, IEEE 802.3 frame format, Ethernet cabling, Manchester encoding, collision detection in 802.3, Binary exponential back off algorithm.

Unit 5. Network Layer:
Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector and link state routing, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms.

Unit6. Transport Layer:
Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de-multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison.

Unit 7. Application Layer:
World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), Introduction to Network security

Reference Books:

1. William Stallings —Computer Networking with Internet Protocols And Technology‖, Pearson Education.

2. Andrew S. Tanenbaum —Computer Networks‖, PHI

3. Keneth C. Mansfield, Jr. James L. Antonakos —An Introduction to Computer Networking‖, PHI.

4. Behrouz A. Forouzan —Data Communications and Networking‖, McGraw Hill

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BTEC-701 Embedded Systems

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I: Arm Processor Architecture

Architecture, Registers, Interrupts & Vector Table, I/O Ports, ARM Processor family, JTAG, I_2C bus

Unit-II: Arm Programming Instructions

Instruction Set: Data processing instructions, Addressing modes, Load Store Instructions, PSR (Program Status Register) Instructions, Conditional Instructions, Interrupt Instructions

Unit-III: C Programming

Integrated Development Environment (IDE) for C/C++ Programming, C/C++ Programs using Function Calls, Pointers, Structures, Integers & Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution & Loops

Unit-IV: Interfacing Peripherals

Interfacing: ADC & DAC, Sensors, Memory, LCD Display, Stepper Motor, DC Motor, SD-MMC Card, Biometric & RFID, ZIGBEE, GSM Interfaces, Debugging Tools

References Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield, —ARM System Developer's Guide Designing and Optimizing System Softwarel, Elsevier 2008.
2. Brooks, Cole, —Embedded Microcontroller Systems, Real Time Interfacingl, Thomson Learning 1999
3. Steve Furber, —ARM system on Chip Architecturel, Addision Wesley
4. Trevor Martin, —The Insider's Guide to The Philips ARM7 - Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series‖ Hitex Ltd.
5. ARM Architecture Reference Manual
6. Website www.arm.com

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BTEC-702 Optical Communication

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction

Need of Fiber Optic Communications, Evolution of Light wave Systems, Basic Concepts; Analog & Digital Signals, Channel Multiplexing, Modulation Formats, Optical Communication Systems, Light wave System Components; Optical Fibers as a Communication Channel, Optical Transmitters, Optical Receivers.

Unit-II Optical Fibers

Geometrical-Optics Description; Step-Index Fibers, Graded Index Fibers, Wave Propagation; Maxwell's Equations, Fiber Modes, Single-Mode-Fibers, Dispersion in Single-Mode Fibers; Group Velocity Dispersion, Material Dispersion, Wave guide Dispersion, Higher-order Dispersion, Polarization-Mode Dispersion, Dispersion-Induced Limitations; Basic Propagation Equation, Chirped Gaussian Pulses, Limitations on the Bit Rate, Fiber Bandwidth , Fiber Losses; Attenuation Coefficient, Material Absorption, Rayleigh Scattering, wave guide Imperfections, Nonlinear Optical effects; Stimulated Light Scattering, Nonlinear Phase Modulation, Four Wave Mixing, Fiber Manufacturing; Design Issues, Fabrication Methods, Cables and Connectors

Unit-III Optical Transmitters

Basic Concepts; Emission and Absorption Rates, p-n Junctions, Non radiative Recombination, Semi conductor Materials, Light Emitting Diodes; Power-current Characteristics, LED spectrum, Modulation Response, LED Structures, Semi Conductor Lasers; DFB Lasers, Coupled Cavity semiconductor Lasers, Tunable Semiconductor Lasers, Vertical Cavity Semiconductor Lasers, Laser Characteristics, Small & Large Signal Modulation, Spectral Line width, Source Fiber Coupling.

Unit-IV Optical Receivers

Basic concepts, p-n Photo Diodes, p-i-n Photo Diodes, Avalanche Photo Diode, MSM Photo detector, Receiver Design, Receiver Noise; Noise mechanism, Receiver sensitivity; Bit error rate, Minimum Receiver Power, Sensitivity Degradation, Receiver Performance.

Unit-V Light Wave Systems

System Architecture, Loss limited Light wave systems, Dispersion limited Light wave systems, Power Budget, Long Haul systems, Sources of Power Penalty; Model Noise, Dispersive Pulse Broadening, Mode Partition Noise, Frequency Chirping, Reflection Feedback Noise

Unit-VI Multi channel Systems

WDM Light wave systems, Optical TDM Systems, Subscriber Multiplexing, Code Division Multiplexing.

Reference Books:

1. Senior J. Optical Fiber Communications, Principles & Practice, PHI.
2. Keiser G., Optical Fiber Communication Mc graw-hill.
3. Govind P. Agrawal, Fiber Optics Communication Systems John Wiley & Sons (Asia) Pvt. Ltd.
4. Djafar K. Mynbeav, —Fiber-Optics Communications Technology‖ Pearson.

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BTEC-703 Lab Wireless and Optical Systems & Networks

Internal Marks: 30
External Marks: 20
Total Marks: 50

L	T	P
0	0	2

1. Study and measurement of attenuation and loss in optical fiber.
2. Study and measurement of bending loss in optical fiber.
3. Study and measurement of numerical aperture of optical fiber.
4. Measurement of optical power using optical power meter.
5. To Study the transmission of TDM signal through optical fiber.
6. To determine the bit rate of the optical fiber link.
7. Study of various multiplexing techniques.
8. To determine the BER of wireless system using M-ARY (BPSK,QPSK,8PSK,16PSK) technique.
9. To determine the BER of wireless system using QAM technique

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BTEC-704 Embedded Systems Lab

Internal Marks: 30
External Marks: 20
Total Marks: 50

L	T	P
0	0	2

List of Experiments

1. Study of ARM7 & ARM9 Bit Processor Architecture and Pin Diagram.
2. Study of Interrupt structure in ARM Processors
3. Write ARM Processor program to Flash LED
4. Interfacing of an LCD Display
5. Write a program to interface an ADC
6. Write a program to generate a Ramp waveform using DAC interface
7. Write a program to control a Stepper Motor
8. Write a program to control the speed of DC motor
9. Interface relays and write a program to control them
10. Interface ZIGBEE with ARM to control more external devices
11. Interfacing of Biometric information recorder
12. Interfacing RFID module with ARM Microcontroller

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BTEC 908 CMOS Based Design

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction to MOS Device

MOS Transistor, MOS models MOS Transistor under static conditions, threshold voltage-Resistive operation, saturation region, channel length modulation, body effect, DC transfer characteristics, Tristate inverters, velocity saturation, Hot carrier effect, drain current Vs voltage charts, sub threshold conduction, MOS structure capacitance, CMOS logic, fabrication and layout, stick diagrams

Unit-II CMOS Processing

CMOS technologies, wafer formation photolithography channel formation, isolation, gate oxide, gate source, drain formation, contacts and metallization, layout design rules, design rule checking,

Unit-III Circuit Characterization & Performance Estimation

Delay estimation, transistor sizing, power dissipation, Sheet resistance, area capacitance, design margin, reliability, Scaling models, scaling factor for device parameters, Advantages and Limitations of scaling.

Unit-IV Design of Combinational Logic

Static CMOS design, complementary CMOS, static properties, complementary CMOS design, Power consumption in CMOS logic gates, dynamic or glitching transitions, Design to reduce switching activity, Radioed logic, DC VSL, pass transistor logic, Differential pass transistor logic, sizing of level restorer, sizing in pass transistor, Dynamic CMOS design, Domino logic, optimization of Domino logic, NPCMOS, Designing logic for reduced supply voltages

Reference Books:

1. Nail H.E. Weste, David Harris, Ayan Banerjee, —CMOS VLSI DESIGNI, Pearson Education.
2. Kang and Leblebici —CMOS Digital integrated circuitsl, TMH 2003.
3. Wayne Wolf, —Modern VLSI Design ", 2nd Edition, Prentice Hall, 1998.
4. Weste & Harris, —CMOS VLSI Design: A Circuits and Systems Perspectivel, 3rd ed, Addison Wesley, 2005.

BTEC 909 Biomedical Signal Processing

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction to Biomedical Signals

Tasks in Biomedical Signal Processing, Computer Aided Diagnosis, Examples of Biomedical signals: ECG, EEG, EMG etc., Review of linear systems, Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals, Processing of Random & Stochastic signals, spectral estimation, Properties and effects of noise in biomedical instruments, Filtering in biomedical instruments

Unit-II Cardio-logical Signal Processing

Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition, Heart rate variability analysis.

Unit-III Adaptive Noise Canceling

Principles of Adaptive Noise Canceling, Adaptive Noise Canceling with the LMS adaptation, Algorithm, Noise Canceling Method to Enhance ECG Monitoring, Fetal ECG Monitoring.

Unit-IV Neurological Signal Processing

Modeling of EEG Signals, Detection of spikes and spindles, Detection of Alpha, Beta and Gamma Waves, Auto Regressive (A.R.) modeling of seizure EEG, Sleep Stage analysis, Inverse Filtering, Least squares and polynomial modeling.

Reference Books:

1. D.C.Reddy,—Biomedical Signal Processing: Principles and techniques‖, Tata McGraw Hill, New Delhi, 2005.
2. Willis J Tompkins, Biomedical Signal Processing, Prentice Hall, 1993
3. R. Rangayan, —Biomedical Signal Analysis‖, Wiley 2002.
4. Bruce, —Biomedical Signal Processing & Signal Modeling,‖ Wiley, 2001.
5. K. Najarian and R. Splinter, —Biomedical Signal and Image Processing‖, Second Edition, The CRC Press,

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BTEC 910 Satellite Communication

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction to Satellite Communication

Origin, Brief History, Current state and advantages of Satellite Communication, Active & Passive satellite, Orbital aspects of Satellite Communication, Angle of Evaluation, Propagation Delay, Orbital Spacing, System Performance

Unit-II Satellite Link Design

Link design equation, system noise temperature, C/N & G/T ratio, atmospheric & econospheric effects on link design, complete link design, interference effects on complete link design, earth station parameters, Earth space propagation effects, Frequency window, Free space loss, Atmospheric absorption, Rainfall Attenuation, Ionospheric scintillation, Telemetry, Tracking and command of satellites.

Unit-III Satellite Multiple Access System

FDMA techniques, SCPC & CSSB systems, TDMA frame structure, burst structure, frame efficiency, super-frame, frame acquisition & synchronization, TDMA vs FDMA, burst time plan, beam hopping, satellite switched, Erlang call congestion formula, DA-FDMA, DA-TDMA.

Unit-IV Satellite Services

INTELSAT, INSAT Series, VSAT, Weather forecasting, Remote sensing, LANDSAT, Satellite Navigation, Mobile satellite Service.

Unit-V Laser & Satellite Communication

Link analysis, optical satellite link Tx & Rx, Satellite, beam acquisition, tracking & pointing, cable channel frequency, head end equation, distribution of signal, n/w specifications and architecture optical fibre CATV system.

Reference Books:

1. Trimothy Pratt, Charles W. Bostian, —Satellite Communications‖, John Wiley & Sons, 1986.
2. Dr. D.C. Aggarwal, —Satellite Communications‖, Khanna Publishers, 2001.
3. Dennis Roddy, —Satellite Communications‖, McGraw Hill, 1996.

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BTEC-911 Artificial Intelligence Techniques & Applications

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I: Introduction

Approaches to intelligent control, Architecture of intelligent control, Linguistic reasoning, Rulebase, Knowledge representation.

Unit-II: Artificial Neural Networks

Biological neuron, Artificial Neural Network, Mathematical Models, McCulloch Neural Model, Perceptron, Adaline and Madaline, Learning & Training in ANN, Hopfield Neural Network, SelfOrganizing Networks, Recurrent Networks, Associative memories

Unit-III: Fuzzy Logic System

Crisp Vs Fuzzy set theory, Membership functions, Fuzzy set operations, Fuzzy rules, Mamdani and Sugeno fuzzy inference systems, Defuzzification methods

Unit-IV: Artificial Neural Networks

Introduction and biological background of GA, String Encoding of chromosomes, Selection methods, Single & multi-point crossover operation, Mutation, Adjustment of strategy parameters such as Population size, Mutation & Crossover probabilities

Unit-V: Tools & Applications

MATLAB Toolboxes: Fuzzy Logic Toolbox, Neural Network Toolbox, FLS for Antilock Breaking System (ABS), GA in route planning for Travelling Sales Person, Time-Series forecasting using ANN

Reference Books:

1. Jacek M. Zurada - Introduction to Artificial Neural Systems
2. S N Sivanandam, S N Deepa - Principles of Soft Computing, Wiley Publications
3. John Yen, Reza Langari - Fuzzy Logic Intelligence, Control, and Information

BTEC 912 Speech & Image Processing

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction to Image Processing

Historical background, visual perception, image formation, Elements of Storage, sampling & Quantization, Relationships between pixels-neighbors of pixel, connectivity labeling of connected components, Relations, equivalence and Transitive closure, Distance measures, Arithmetic/ Logic operation, Imaging Geometry Basic and perspective transformation stereo imaging, application of image Processing.

Unit-II Image Enhancement

Spatial and frequency domain methods point processing, intensity transformation, Histogram processing image substation and Averaging spatial filtering, LP, HP and homo-morphic felling generation of spatial marks, Color image processing.

Unit-III Image Compression

Redundancy models, error free compression, Lossy compression, Image compression standards.

Unit-IV Image Segmentation

Detection of Discontinuity, Edge detection, Boundary detection, Thresholding, Regional oriented segmentation, use of motion in segmentation.

Unit-V Speech Processing

Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing-the phasor mode, Fourier transfer, DFT, FFT. The hardware use of FIR & IIR filters. Software, Elements of speech Synthesisspeech Recognition-speech in the computer-human interface.

Reference Books:

1. Digital Image Processing - by Rafact Gonzalez and Richard E. Woods, Pearson Education Society.
2. Digital Image Processing - by Keenneth R Castleman, Pearson Education Society.
3. A. K. Jain, —Fundamental of Digital Image Processing‖, PHI
4. Speech and Audio Processing for multimedia PC's - by Iain Murray

BTEC 913 Human Resource Management

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction to Human Resource

Definition, Role and Functions of Human Resource Management, Concept and Significance of HR. Changing role of HR managers, HR functions and Global Environment, role of a HR Manager.

Unit-II Human Resources Planning

Need and Process for Human Resource Planning, Methods of Recruitment, Planning Process, Planning at different levels, Recruitment and selection processes, Sources of Recruitment, Restructuring strategies, Placement and Induction, Retention of Employees, , Employment Exchanges (Compulsory Notification of vacancies).

Unit-III Training and Development

Principles of Training, Employee Development, Need for skill up gradation, Assessment of training needs, Retraining and Redeployment methods and techniques of training employees and executives, performance appraisal systems Career Development & Planning.

Unit-IV Job analysis, Design and Satisfaction

Job Analysis: Job Description & Job Description, Job Specification, Job satisfaction and its importance; Motivation, Factors affecting motivation, introduction to Motivation Theory; Workers' Participation, Quality of work life.

Unit-V Industrial Relations

Factors influencing industrial relations, State Interventions and Legal Framework, Role of Trade unions, Collective Bargaining, Worker's participation in management.

Reference Books:

1. T.N.Chhabra- Human Resource Management (Dhanpat Rai & Co.).
2. Gary Dessler, Human Resource Management (8th ed.), Pearson Education, Delhi
3. Biswajeet Patanayak, Human Resource Management, PHI, New Delhi
4. A Minappa and M. S. Saiyada - Personnel Management (Tata Mc. Graw-Hill)

BTEC 914 Computer organization and Architecture

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction

Organization and Architecture, Structure and Function, Brief History of Computers, Designing for Performance, Performance metrics; MIPS, MFLOPS, Computer Components and Functions, Interconnection Structures, Bus Interconnection, Point-To-Point Interconnect, PCI Express, Flynn's classification of computers (SISD, MISD, MIMD.

Unit-II Internal and Cache Memory

Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Pentium 4 Cache Organization, Semiconductor Main Memory, Advanced Dram Organization

Unit-III Basic non pipelined CPU Architecture and Operating System

CPU Architecture types (accumulator, register, stack, memory/ register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3 to 5 stage), microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining. Operating System Overview, Scheduling, Memory Management, Pentium Memory Management.

Unit-IV Parallel Processing and Multi-core Computer

Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI Protocol, Multithreading and Chip Multiprocessors, Clusters, Non-uniform Memory Access, Vector Computation, Multi-core Computers, Hardware and Software Performance Issues, Multi-core Organization, Intel x86 Multi-core Organization.

Reference Books:

1. William Stallings, Computer Organization and Architecture, 9/E, Pearson, Delhi.
2. Computer Architecture and Organization, 3rd Edi, by John P. Hayes, 1998, TMH.
3. Chaudhuri P. Pal, —Computer Organisation &Design‖, PHI,
4. Mano, M.M., —Computer System Architecture‖, PHI.

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BTIT 504 Cyber Law & IPR

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Basics of Computer & Internet Technology

Internet, ISP & domain name; Network Security; Encryption Techniques and Algorithms; Digital Signatures

Unit-II Introduction to Cyber World

Introduction to Cyberspace and Cyber Law; Different Components of cyber Laws; Cyber Law and Netizens.

Unit-III E-Commerce

Introduction to E-Commerce; Different E-Commerce Models; E-Commerce Trends and Prospects; E-Commerce and Taxation; Legal Aspects of E-Commerce.

Unit IV- Intellectual Property Rights

IPR Regime in the Digital Society; Copyright and Patents; International Treaties and Conventions; Business Software Patents; Domain Name Disputes and Resolution.

Unit V- IT ACT 2000

Aims and Objectives; Overview of the Act; Jurisdiction; Role of Certifying Authority; Regulators under IT Act; Cyber Crimes-Offences and Contraventions; Grey Areas of IT Act.

Unit VI- Project Work

Candidates will be required to work on a project. At the end of the course students will make a presentation and submit the project report.

Reference Books:

1. Nandan Kamath, —A Guide to Cyber Laws & IT Act 2000 with Rules & Notificationl.
2. Law and practice of intellectual property in India by Vikas Vashishth
3. Intellectual property- patents, copyrights, trademarks and allied rights by Cornish W R
4. Keith Merill & Deepti Chopra (IK Inter.), Cyber Cops, Cyber Criminals & Internet

Vakul Sharma (Mc Millian), Handbook of Cyber Laws

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BTEC-915 Electromagnetic Interference & Compatibility

Internal Marks : 40 L T P

External Marks : 60 3 1 0

Total Marks : 100

Unit-I Overview of EMI/EMC:

Electromagnetic environment, History, Concepts and definitions, Overview of EMI/EMC, Natural and Nuclear sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters.

Unit-II EMI Coupling Principles:

Electromagnetic emissions, noise from relays and switches, Nonlinearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Cable to Cable Coupling, Power Mains and Power Supply coupling.

Unit-III Radiated and Conducted Interference Measurements:

EMI Test Instruments/ Systems, Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents/voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI, detectors and measurements, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/ Injectors/ Couplers, Test beds for ESD and EFT.

Unit-IV EMI Control Techniques:

Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design shielding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting, PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

Reference Books:

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press,1996.
2. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, New York, 1988.
3. C.R.Paul, —Introduction to Electromagnetic Compatibility‖ , John Wiley and Sons, Inc, 1992
4. Bernhard Keiser, "Principles of Electromagnetic Compatibility", Artech house, 3rd Ed, 1986.

BTECH-916 Neural Networks And Fuzzy Logic

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I: Introduction To Neural Networks

Human brain and Biological Neuron, Artificial Neural Network, ANN Terminology, McCulloch-Pitts Neural Model, Activation functions, Topology, Feedforward Neural Networks, ANN Learning: Supervised, Un-supervised, Competitive learning, Reinforcement learning, Knowledge representation.

Unit-II: Hopfield Neural Model

Learning Laws:- Hebb's rule, Delta rule, Widrow & Hoff LMS learning rule, Correlation learning rule, Instar and Outstar learning rules, Back-propagation Neural Networks, K-means clustering algorithm, Kohenen's feature maps, Associative Memories

Unit-III: Radial Basis Neural Networks

Function Neural Networks, Basic learning laws in RBF Nets, Recurrent Networks, Recurrent Backpropagation, Counter-Propagation Networks, CMAC Networks, ART Networks.

Unit-IV: Fuzzy Logic Sets & System

Introduction to Fuzzy Logic, Fuzzy Vs Crisp set, Linguistic variables, Membership functions, Fuzzy set operations, IF-THEN fuzzy rules, Mamdani & Sugeno inference techniques Defuzzification techniques, Fuzzy Logic System: Block diagram, Implementation, Useful tools Fuzzy logic controller Vs PID controller, Antilock Braking System (ABS).

Reference Books:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley publications.
2. Yagna Narayanan - Artificial Neural Networks
3. Bart Kosko - Neural Networks & Fuzzy logic
4. Simon Haykin - Neural Networks

BTEC 917 Robotics

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction

Definition and Need for Robots, Robot Anatomy, Co-ordinate Systems, Work Envelope, types and classification, Specifications, Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load, Robot Parts and Their Functions, Different Applications

Unit-II Sensors

Principles and Applications and need of a sensor, Principles, Position of sensors, Piezo-Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors, Range Sensors, Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters, Proximity Sensors, Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors, Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors,

Unit-III Drive Systems & Grippers for Robot

Drives systems (Mechanical, Electrical, Pneumatic Drives, Hydraulic), D.C.Servo Motors, Stepper Motor, A.C. Servo Motors, Comparison of all Drives, End Effectors, Grippers (Mechanical, Pneumatic, Hydraulic, Magnetic, Vacuum Grippers), Two Fingered and Three Fingered Grippers, Internal Grippers and External Grippers, Selection and Design Considerations

Unit-IV Machine Vision

Camera, Frame Grabber, Sensing and Digitizing Image Data, Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis, Data Reduction, Edge detection, Segmentation Feature Extraction, Object Recognition, Other Algorithms, Applications, Inspection, Identification, Visual Serving and Navigation.

Unit-V Robot Kinematics & Programming

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional), Deviations and Problems Teach Pendant Programming, Lead through programming, Robot programming Languages, VAL Programming, Motion Commands, Sensor Commands, End effecter commands.

Reference Books:

1. M.P.Groover, —Industrial Robotics - Technology, Programming and Applications‖, McGraw-Hill, 2001.
2. Ghosal, A., Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2nd reprint, 2008.
3. Yoram Koren, —Robotics for Engineers‖, McGraw-Hill Book Co., 1992.
4. Fu, K., Gonzalez, R. and Lee, C.S. G., Robotics: Control, Sensing, Vision and Intelligence, McGraw- Hill, 1987.

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BTEC 918 Operation Research

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction to Operations Research

Definition, scope, objectives, phases, models and limitations of Operations Research, Linear Programming Problem, Formulation of LPP, Graphical solution of LPP, Simplex method, slack, surplus and artificial variables, Concept of duality, big-M method two phase method, dual simplex method, degeneracy and unbound solutions, procedure for resolving degenerate cases.

Unit-II Transportation Problem

Formulation of transportation model, Optimality Methods, Unbalanced transportation problem, Basic feasible solution, Northwest corner rule, least cost method, Vogel's approximation method, Applications of Transportation problems, Assignment Problem, Formulation, unbalanced assignment problem, Traveling salesman problem, Optimality test, the stepping stone method, MODI method.

Unit-III Sequencing Models

Johnsons algorithm, Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines, Graphical solutions priority rules.

Unit-IV Dynamic programming

Characteristics of dynamic programming, Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.

Unit-V Games Theory

Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point - mixed strategy for 2 X 2 games.

Reference Books:

1. Operations Research and Introduction, Taha H. A. - Pearson Education edition.
2. P. Sankara Iyer, Operations Research, Tata McGraw-Hill, 2008.
3. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, —Operations Researchl, Pearson Education, 2005.
4. Operations Research, S. D. Sharma -Kedarnath Ramnath & Co 2002.

BTEC 919 Mobile Computing

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems

Unit II Mobile Network & Transport Layer

Mobile IP Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, Dynamic Host Configuration Protocol (DHCP), Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Unit III Wireless Networking

Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit III Mobile Ad hoc Networks

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment, Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Reference Books:

1. J. Schiller, Mobile Communications, Addison-Wesley, second edition, 2004.
2. Raj Pandya, Mobile & Personal Communication Systems and Service, PHI.
3. Asoke k Talukder , Roopa R Yavagal, Mobile Computing , Technology, Application & Service Creation. Tata Mc Graw Hill
4. Stojmenovic and Cacute, —Handbook of Wireless Networks and Mobile Computing‖, Wiley, 2002.

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BTEC 920 Wireless Sensor Network

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Introduction to Wireless Sensor Networks

Constraints and Challenges of sensor networks, Emerging technologies for wireless sensor networks, Node architecture, Hardware components overview, Energy consumption of Sensor nodes, Dynamic energy and power management on System level, some examples of Sensor nodes, Optimization goals and figures of merit, QOS, Energy Efficiency, scalability, robustness Advantages of sensor networks, Sensor network applications.

Unit-II Topology Control

Location driven, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding (GeRaF), GEAR, Connectivity driven, SPAN, ASCENT.

Unit-III WSN Sensors

Physical Layer Design, Transceiver Design, MAC Protocols for WSN, Low Duty Cycle Protocols & Wakeup Concepts, S-MAC, Mediation Device Protocol, Wakeup Radio Concepts, Address & Name Management, Assignment of MAC Addresses, Routing Protocols, Energy Efficient Routing, Geographic Routing.

Unit-IV WSN Platforms & Tools

Sensor Node Hardware, Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Reference Books:

1. Holger Karl & Andreas Willig, "Protocols & Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, —Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Waltenegus Dargie and Christian Poellabauer, —Fundamentals of Wireless Sensor Networks - Theory and Practicel, John Wiley and Sons, first edition, 2010.
4. Holger Karl and Andreas Willig, —Protocols and Architectures for Wireless Sensor Networksl, John Wiley and Sons, 2007.

BTEC 921 Numerical Methods

Internal Marks: 40
External Marks: 60
Total Marks: 100

L	T	P
3	1	0

Unit-I Errors in Numerical Calculation

Numbers and their accuracy, Mathematical preliminaries, Errors and their computation, General error formula, Error in a series approximation. Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods.

Unit-II Solution of Equations

Linear interpolation methods, Newton's method, Statement of Fixed Point Theorem, Fixed point iteration, Gaussian elimination and Gauss-Jordon methods, Gauss Jacobi and Gauss-Seidel methods, Inverse of a matrix by Gauss Jordon method.

Unit-III Interpolation

Interpolation: Finite differences, difference tables, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals, Numerical differentiation, Numerical integration: Newton-Cotes formula, Trapezoidal, Simpson's one third and three-eight rules,

Unit-IV Numerical Solution of Ordinary Differential Equations

Single step methods: Taylor series method - Euler and modified Euler methods - Fourth order Runge - Kutta method for solving first and second order equations - Multistep methods: Milne's and Adam's predictor and corrector methods.

Reference Books:

1. Gerald, C.F, and Wheatley, P.O, —Applied Numerical Analysis‖, Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Balagurusamy, E.,—Numerical Methods‖, Tata McGraw-Hill Pub. Co. Ltd, Delhi, 1999.
3. S. S. Sastry, Introductory Methods of Numerical Analysis, 3rd ed. PHI, Delhi (2002).
4. B. S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, Delhi.

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Scheme and Syllabus

of

M. Tech.

Electronics and Communication Engineering

(Wireless Communication)

BATCH-2011

Punjab Institute of Technology, Kapurthala

(A constituent college of Punjab Technical University)

PTU

First Semester

Course Code	Course Title	Load Allocation				Marks Distribution			Credits
		L	T	P	Hours/Week	Internal	External	Total	
ECL-101	Research Methodology	3	1	-	4	40	60	100	4
ECE-(1XX)	Elective – I	3	1	-	4	40	60	100	4
ECL-102	Information Theory & Coding	3	1	-	4	40	60	100	4
ECL-103	Wireless Communication	3	1	-	4	40	60	100	4
ECE-(1XX)	Elective – II	3	1	-	4	40	60	100	4
Total		15	5	-	20	200	300	500	20

Second Semester

Course Code	Course Title	Load Allocation				Marks Distribution			Credits
		L	T	P	Hours/Week	Internal	External	Total	
ECL-201	Advanced Wireless Communication	3	1	-	4	40	60	100	4
ECL-202	Simulation Of Wireless Communication Systems	3	1	-	4	40	60	100	4
ECL-203	Soft Computing Techniques	3	1	-	4	40	60	100	4
ECE-(1XX)	Elective –III	3	1	-	4	40	60	100	4
ECE-(1XX)	Elective –IV	3	1	-	4	40	60	100	4
ECP-101	Wireless Simulation Laboratory	-	-	4	4	60	40	100	2
Total		15	5	3	20	260	340	600	22

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Third Semester

Course Code	Course Title	Load Allocation				Marks Distribution			Credits
		L	T	P	Hours/Week	Internal	External	Total	
ECE-(1XX)	Elective – V	3	1	-	4	40	60	100	4
ECE-(1XX)	Elective – VI	3	1	-	4	40	60	100	4
ECS-101	Seminar	-	-	2	2	100	-	100	2
ECD-101	Dissertation (Part – I)	-	-	8	8	60*	40	100	8
Total		6	2	10	18	260	140	400	18

Fourth Semester

Course Code	Course Title	Load Allocation	Marks Distribution			Credits
			Internal	External	Total	
ECD-101	Dissertation (Part - II)	24Hours per week	60*	40**	100	20

***To be evaluated by department research committee.**
****To be evaluated by student research committee along-with external examiner.**

Elective – I, II, III, IV, V and VI is to be chosen from the set list of electives.

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List of Electives*

1. ECE-101 Advanced Digital Signal Processing
2. ECE-102 Advanced Communication Systems
3. ECE-103 Smart Antennas
4. ECE-104 RF MEMS For Wireless Communications
5. ECE-105 CDMA Technology
6. ECE-106 Wireless Sensor Networks
7. ECE-107 Software Defined Radio
8. ECE-108 Bluetooth Technology
9. ECE-109 Soft Computing Techniques
10. ECE-110 Emerging Technologies in wireless communications
11. ECE-111 Advanced Antenna Systems
12. ECE-112 Space Time Wireless Communication
13. ECE-113 Wireless Protocols and Architecture
14. ECE-114 Microwave and RF Design
15. ECE-115 Audio and Video Signal Processing
16. ECE-116 Detection and Estimation Theory
17. ECE-117 Mobile Ad hoc Networks
18. ECE-118 Wireless LAN and PAN
19. ECE-119 Wireless Security
20. ECE-120 Advanced Wireless Networks

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Syllabus Already covered in 1st Sem

Research Methodology

Overview of Research

Research and its types, identifying and defining research problem and introduction to different research designs. Essential constituents of Literature Review. Basic principles of experimental design, completely randomized, randomized block, Latin Square, Factorial, response surfaces (8)

Methods of Data Collection

Primary data and Secondary Data, methods of primary data collection, classification of secondary data, designing questionnaires and schedules. (4)

Sampling Methods

Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non-probability sampling: convenience sampling, judgement sampling, quota sampling. Sampling distributions. (8)

Processing and analysis of Data

Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses: Parametric (t, z and F) Chi Square, ANOVA, and non-parametric tests. (8)

Multivariate Analysis

Multiple Regression, Factor Analysis, Discriminant Analysis, Cluster Analysis, multidimensional scaling (6)

Reliability and Validity

Test-retest reliability, alternative-form reliability, internal-comparison reliability, and scorer reliability. Content validity, criterion-related validity, and construct validity. (3)

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Essential of Report writing (3)

Note: Application and use of various software for case studies should be essential

Reference Books

Levin, R.I. and Rubin, D.S., Statistics for Management, 7th Edition, Pearson Education: New Delhi.
Malhotra, N.K., Marketing Research An Applied Orientation, 4th Edition Pearson Education: New Delhi.
Zikmund, W.G., Business Research Methods, 7th Edition, Thomson South-Western.
Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Pearson Education: New Delhi.
Kothari C.R., Research Methodology Methods and techniques by, New Age International Publishers, 2nd edition

ADVANCED COMMUNICATION SYSTEMS

- **INTRODUCTION**

  Introduction to communications systems, analog and digital communication systems, Applications of communication systems.

- **DIGITAL COMMUNICATION**

  Introduction, Digital Modulation techniques, BPSK, QPSK, PCM, DPCM, Delta Modulation, Digital Transmission and Transmission Impairments.

- **OPTICAL NETWORKS**

  WDM, TDM, Telecommunication Infrastructure, Switching, 3G systems, SONET, SDH, Architecture of Optical Transport Network, Link Management Protocols, Solutions.

- **SATELLITE COMMUNICATION**

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Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design Of Down Links, Domestic Satellite Systems Using Small Earth Stations, Uplink Design, Design Of Satellite Link For Specified (C/N). Multiple Access Techniques, Frequency Division Multiple Access(FDMA), TDMA, CDMA, Estimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT

- **MOBILE COMMUNICATIONS**

Mobile telephone service, Transmission protocols, Introduction to GSM, GPRS, CDMA, Switching techniques, Fading, Quality of service (QOS).

BOOKS:

1. Advanced Communication Systems - by Wayne Tomasi; Pearson.
2. Digital Communication - by Proakis; PHI
3. Optical Networks - by Uyless Black; Pearson
4. Satellite Communication - by Timothy Pratt; Addison Wesley.
5. Related IEEE/IEE publications

WIRELESS COMMUNICATION

Physical modelling for wireless channels :
Free space, fixed transmit and receive antennas, Free space, moving antenna, Reflecting wall, fixed antenna, Reflecting wall, moving antenna, Reflection from a ground plane, Power decay with distance and shadowing, Moving antenna, multiple reflectors

Input /output model of the wireless channel :
The wireless channel as a linear time-varying system, Baseband equivalent model, discrete-time baseband model, Additive white noise

Time and frequency coherence :
Doppler spread and coherence time, delay spread and coherence bandwidth

AWGN channel capacity :
Repetition coding, Packing spheres, Capacity-achieving AWGN channel codes, Reliable rate of communication and capacity, Resources of the AWGN channel-Continuous-time AWGN channel,
Power and bandwidth, Bandwidth reuse in cellular systems

Linear time-invariant Gaussian channels :
Single input multiple output (SIMO) channel, Multiple input single output (MISO) channel, Frequency-selective channel

Capacity of fading channels :
Slow fading channel, Receive diversity, Transmit diversity, Transmit and receive diversity, Time and frequency diversity, Outage for parallel channels, Fast fading channel, Transmitter side information, Frequency-selective fading channels

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Uplink and Downlink AWGN channel :
Capacity via successive interference cancellation, Comparison with conventional CDMA, Comparison with orthogonal multiple access, General K-user uplink capacity, Symmetric case: two capacity achieving schemes, General case: superposition coding achieves capacity
Uplink and Downlink fading channel :
Slow fading channel, Fast fading channel, Full channel side information, Channel side information at receiver only, Full channel side information, Frequency-selective fading channels
Multiuser diversity :
Multiuser diversity gain, Multiuser versus classical diversity, Fair scheduling and multiuser diversity, Channel prediction and feedback, Opportunistic beam forming using dumb antennas, Multiuser diversity in multicell systems
Physical modeling of MIMO channels :
Line-of-sight SIMO channel, Line-of-sight MISO channel, Antenna arrays with only a line-of-sight path, Geographically separated antennas, Line-of-sight plus one reflected path, MIMO multipath channel, Angular domain representation of signals, Angular domain representation of MIMO channels, Statistical modeling in the angular domain, Degrees of freedom and diversity, Dependency on antenna spacing

1.Andrea Goldsmith."Wireless Communications" Cambridge University Press,2005
2. David Tse,Pramod Viswanath"Fundamentals of Wireless Communications" Cambridge University Press 2005

ADVANCED DIGITAL SIGNAL PROCESSING

Review :

Fourier Transforms, Z-Transforms, Discrete Fourier Transform, Fast Fourier Transform, Convolution And Correlation.

Design of digital filters:

Introduction to filter design, types of digital filters,choosing between, fir and iir filters, filter design steps, effect of finite register length in filter design, realization of iir digital filters and fir digital filter, design of iir filters from continuous time filters, design of fir filters by windowing.

Digital signal processors:

General and special purpose digital signal processors, computer architecture for signal processing, selecting digital signal processors, architecture and programming of ADSP 2181 processor.

Spectrum estimation:
non-parametric methods correlation method, co-variance estimator, performance analysis of estimators, consistent estimators, ar, ma, ARMA signal modeling parameter estimation using Yule-walker method.

Linear estimation and predication:

Maximum likelihood criterion efficiency of estimator, least mean squared error criterion, recursive estimators, and linear predications.

Multirate digital signal processing:

Mathematical description of change of sampling rate, interpolation and decimation, continuous time model, direct digital domain approach, interpolation and decimation by an integer factor, single and multistage realization, applications of sub band coding.

Adaptive Filters:

Applications Of Adaptive Filters, Adaptive Direct Form FIR Filters: The LMS Algorithm, Adaptive Lattice Ladder Filters, Recursive Least Squares Lattice Ladder Algorithms.

BOOKs/REFERENCE

- Monson H.Hayes, " Statistical Digital Signal Processing and Modeling ", John Wiley and Sons, Inc., New York, 1996
- Emmanuel C.Ifeachor Barrie W.Jervis, "Digital Signal Processing", Pearson Education Asia
- Proakes Manolakis ," Digital Signal Processing principles, algorithms, and applications", Prentice Hall India
- ADSP 2181 manuals
- Keshab K. Parhi, " VLSI DSP Systems; Design & implementation" , Wiley InterScience Publishers

Moonen, Ian k. Proudler, " Algorithms for statistic

INFORMATION THEORY & CODING

UNIT I INFORMATION THEORY

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit.

UNIT II SOURCE CODING: TEXT, AUDIO AND SPEECH

Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding

UNIT III SOURCE CODING: IMAGE AND VIDEO

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard

UNIT IV ERROR CONTROL CODING: BLOCK CODES

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC

UNIT V ERROR CONTROL CODING: CONVOLUTIONAL CODES

Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding

TEXT BOOKS:

1. R Bose, "Information Theory, Coding and Crptography", TMH 2007
2. Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002

REFERENCES:

1. K Sayood, "Introduction to Data Compression" 3/e, Elsevier 2006
2. S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007
3. Amitabha Bhattacharya, "Digital Communication", TMH 2006

Proposed core subjects syllabi for 2nd Sem

SIMULATION OF WIRELESS COMMUNICATION SYSTEMS

UNIT-I: Introduction to simulation approach

Methods of performance evaluation-simulation approach- Advantages and limitations. System model steps and its types involved in simulation study. Error sources in simulation. Role of simulation in communication system and random process. Introduction to random variables - univariate models (discrete and continuous) and multi-variate models.

UNIT-II: Review of Stochastic process and parameter estimation

Stochastic process: Definitions, properties – stationarity, time averaging and ergodicity, random process models .

Parameter estimation: Quality of an estimator, estimating average power probability density function, estimation of power spectral density of a process, delay and phase. SNR estimation and importance sampling.

UNIT-III, Numerical methods for wireless Communication Systems: numerical differentiation,integration,differential equation.

Monte Carlo simulation: concepts and integration,Application in wireless Communication Systems.

UNIT-III: Modeling of Communication systems

, properties, generation and techniques for generating random numbers and processes.

Introduction to modeling of communication systems - Information sources, source coding, base band modulation, channel coding, RF and optical modulation, filtering, multiplexing, detection/demodulation- carrier and timing recovery for BPSK and QPSK. Modeling considerations for PLL.

UNIT-IV: Communication channel models

Statistical characterization of multipath channels and time-varying channels with Doppler effects,models for multipath fading channels. Finite state channel models – channels with and without memory.Methodology for simulating communication systems operating over fading channels.

TEXT BOOKS:

1. M.C. Jeruchim, Philip Balaban & K.Sam shanmugam. "Simulation of communication systems", Plemum press, New York, 1992
2. M.Law & W.David Kelton ," Simulation Modelling and analysis" ,McGraw Hill, New York, 1999.
3. K.Hayes, "Modelling and Analysis of computer communication networks", Plenum press, New York,1984.
4. Banks, J.S.Carson, Nelson and D.M.Nicol, "Discrete –Event system simulation",Prentice Hall of India, 4th Edition, 2005.
5. Z.Peebles , "Probability, Random Variable and Random Signal Principles", Tata McGraw Hill, 4th edition 2002.

DESIGN AND SIMULATION OF WIRELESS LABORATORY

1. Generation of Voice, Data and Video traffic.
2. Simulation of the Radio Channel.
3. Simulation of Hand off mechanisms.
4. Simulation of CDMA Transmitter and Receiver.
5. Coding Techniques for Wireless Communication.
6. Link Budget.33
7. Simulation of Security Algorithms.
8. Study of Glomosim and NS2.

Soft Computing Techniques

Artificial Neural Network

Basic concept of Soft Computing; Basic concept of neural networks, Mathematical model, Properties of neural network, Typical architectures: single layer, multilayer, competitive layer; Different learning methods: Supervised, Unsupervised & reinforced; Common activation functions; Feed forward, Feedback & recurrent N.N; Application of N.N; Neuron.

Pattern Recognition

Pattern Classification, Pattern Association, Clustering, Simple Clustering algorithm, k-means & k-medoid based algorithm.

Models Of Neural Network

Architecture, Algorithm & Application of -- McCulloh-Pitts, Hebb Net, Perceptron (with limitations & Perceptron learning rule Convergence theorem), Backpropagation NN, ADALINE, MADALINE, Discrete Hopfield net, BAM, Maxnet , Kohonen Self Organizing Maps, ART1,ART2.

Fuzzy Sets & Logic

Fuzzy versus Crisp; Fuzzy sets—membership function, linguistic variable, basic operators, properties; Fuzzy relations—Cartesian product, Operations on relations; Crisp logic—Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic—Quantifiers, Inference; Fuzzy Rule based system; Defuzzification methods; FAM;

Genetic Algorithm

Basic concept; role of GA in optimization, Fitness function, Selection of initial population, Cross over(different types), Mutation, Inversion, Deletion, Constraints Handling; Evolutionary Computation; Genetic Programming; Schema theorem; Multiobjective & Multimodal optimization in GA; Application—Travelling Salesman Problem

Hybrid soft computing Techniques

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GA based BPNN(Weight determination, Application); Neuro Fuzzy Systems—Fuzzy BPNN--fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G.A;

Books:

1. Principles of Soft Computing –S. N. Sivanandam,S.N. Deepa; Wiley India
2. Neural Networks- A Comprehensive foundation, Simon Haykin, 2nd Ed; Pearson
3. Neural Networks, Fuzzy Logic & Genetic Algorithms – Synthesis & applications, T.S. Rajasekaran & G.A. Vijaylakshmi Pai, PHI
4. Genetic Algorithm & fuzzy Logic Systems - Sanchez, Takanori, Zadeh; World Scientific
5. Genetic Algorithm, Goldberg David E.; Pearson
6. Fuzzy Set Theory & Its Applications - Zimmermann H. J.; Allied Publishers

ADVANCED WIRELESS COMMUNICATION

UNIT-I: REVIEW OF FUNDAMENTALS OF WIRELESS COMMUNICATION: MULTIPATH FADING, MULTIPATH CHANNEL MODELS, CAPACITY OF WIRELESS CHANNELS.

UNIT-II: PERFORMANCES OF DIGITAL MODULATION OVER WIRELESS CHANNELS: AGWN CHANNELS SIGNAL TO NOISE POWER RATIO AND BIT/SYMBOL ENERGY, ERROR PROBABILITY FOR BPSK, QPSK, MPSK,MPAM, MQAM- THEIR COMPARISION.

UNIT-III: MULTICARRIER MODULATION: DATA TRANSMISSION USING MULTIPLE CARRIERS, MULTICARRIER MODULATUION WITH OVERLAPPING SUBCHANNELS, MITIGATION OF SUBCARRIER FADING, DISCRETE IMPLEMENTATION OF MULTICARRIER MODULATION, CHALLENGES IN MULTICARRIER SYSTEMS.

UNIT-IV: INTRODUCTION TO WIRELESS OFDM: OFDM PRINCIPLES, SYSTEM MODEL, GENERATION OF SUB CARRIER USING IFFT, GUARD TIME, CYCLIC EXTENSION, WINDOWING, OFDM PARAMETERS, OFDM SIGNAL PROCESSING, COHERENT AND DIFFERENTIAL DETECTION

UNIT-V: OFDMA: FREQUENCY HOPPING IN OFDMA, DIFFERENCE BETWEEN OFDMA AND MC-CDMA, OFDMA SYSTEM DESCRIPTION-CHANNEL CODING, FREQUENCY SYNCHRONIZATION, INITIAL MODULATION TIMING ANF FREQUENCY OFFSET SYNCHRONIZATION ACCURACY, RANDOM FREQUENCY HOPPING OPERATION, APPLICATIONS OF OFDMA.

Books:

A.Goldsmith, "Wireless Communications, Cambridge Univ. Press, 2005.

R.Vannee and R.Prasad, "OFDM for Wireless Multimedia Communication, Artech House, 2000.

M.Engels, Wireless OFDM systems, Klumer Academic Publishers, 2002.

SMART ANTENNAS FOR WIRELESS COMMUNICATIONS

Unit-I:

INTRODUCTION TO SMART ANTENNAS, WHY SMART ANTENNAS, BENEFITS OF SMART ANTENNAS, SPATIAL PROCESSING FOR WIRELESS SYSTEMS, WIDEBAND SMART ANTENNAS, HISTORICAL DEVELOPMENT

Unit-II:

ANTENNA FUNDAMENTALS – ANTENNA FIELD REGIONS, POWER DENSITY, RADIATION INTENSITY, ANTENNA NOMENCLATURE, FRIIS TRANSMISSION FORMULA, LINEAR ANTENNAS, LOOP ANTENNAS.

Unit-III:

ARRAY FUNDAMENTALS – LINEAR ARRAYS, ARRAY WEIGHTING, CIRCCULAR ARRAYS, RECTANGULAR ARRAYS, FIXED BEAM AND RETRODIRECTIVE ARRAYS.

Unit-IV:

BEAMFORMING BASICS – MAXIMUM SIGNAL TO INTERFERENCE RATIO, MINIMUM MEAN SQUARE RATIO, MINIMUM VARIANCE, ADAPTIVE BEAMFORMING, DESCRIPTION OF NEW SDMA RECEIVER, SOFTWARE RADIOS FOR SMART ANTENNAS..

Unit-V:

SMART ANTENNA TECHNIQUES FOR CDMA, NON-COHERENT CDMA SPATIAL PROCESSORS, COHERENT CDMA SPATIAL PROCESSORS AND THE SPATIAL PROCESSING RAKE RECEIVER, MULTI-USER SPATIAL PROCESSING, DYNAMIC RE-SECTORING USING SMART ANTENNAS, DOWNLINK BEAMFORMING FOR CDMA.

BOOKS

- Gross F.B. "Smart Antennas for Wireless Communications with MATLAB", McGraw-Hill, New York, 2005.
- Balanis A., "Antenna Theory Analysis and Design", John Wiley and Sons, Newyork, 1982
- Joseph C. Liberti, Theodore S. Rappaport - "Smart Antennas for Wireless Communications:IS95 and third generation CDMA Applications", Prentice Hall Communications Engineering and Emerging Technologies Series

- **Wireless Sensor Networks**

- **Unit I**
- Introduction: the vision, Networked wireless sensor devices, Applications, Key design challenges.
- Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

- **Unit II**
- Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization, Theoretical analysis of localization techniques.

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- Synchronization: Issues & Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.
- **Unit III**
- Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.
- Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.
- Sleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage, Set K-cover algorithms.
- **Unit IV**
- Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks.
- Data-centric networking: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.
- Reliability and congestion control: Basic mechanisms and tunable parameters, Reliability guarantees, Congestion Control, Real-time scheduling.
- **Books:**

- 1. Wireless Sensor Networks: Technology, Protocols, and Applications: Kazem Sohraby, Daniel Minoli, Taieb Znati , Wiley Inter Science.
- 2. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
- 3. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati , Springer.
- 4. Networking Wireless Sensors: Bhaskar Krismachari, Cambridge University Press
- 5. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and Milind Tambe , Kluwer Publications.
- 6. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.
- 7.Waltenegus Dargie And Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks: Theory And Practice" . John Wiley & Sons, August 2010.

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Study Scheme & Syllabus of

Bachelor of Technology

(1st and 2nd semester)

Batch 2018 onwards

By

Department of Academics

IK Gujral Punjab Technical University

Head
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Bachelors of Technology 1st and 2nd semester
It is an Under Graduate (UG) Programme of 4 years duration (8 semesters)
Eligibility for Admission: *As per AICTE norms.*

First Semester **Physics Group** **Contact Hrs. : 24**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTPHXX-18	Basic Science Course	Physics	3	1	0	40	60	100	4
BTPHXX-18	Basic Science Course	Physics (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-I	3*	1	0	40	60	100	4
BTEE101-18	Engineering Science Course	Basic Electrical Engineering	3	1	0	40	60	100	4
BTEE102-18	Engineering Science Course	Basic Electrical Engineering (Lab)	0	0	2	30	20	50	1
BTME101-18	Engineering Science Courses	Engineering Graphics & Design	1	0	4	60	40	100	3
BMPD101-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
TOTAL			10	3	11	220	280	500	17.5

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

First Semester **Chemistry Group** **Contact Hrs. : 29**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCH101-18	Basic Science Course	Chemistry-I	3	1	0	40	60	100	4
BTCH102-18	Basic Science Course	Chemistry-I (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-I	3*	1	0	40	60	100	4
BTPS101-18	Engineering Science Course	Programming for Problem Solving	3	0	0	40	60	100	3
BTPS102-18	Engineering Science Course	Programming for Problem Solving (Lab)	0	0	4	30	20	50	2
BTMP101-18	Engineering Science Courses	Workshop / Manufacturing Practices	1	0	4	60	40	100	3
BTHU101-18	Humanities and Social Sciences including Management courses	English	2	0	0	40	60	100	2
BTHU102-18	Humanities and Social Sciences including Management courses	English (Lab)	0	0	2	30	20	50	1
BMPD101-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
TOTAL			12	2	15	290	360	650	20.5

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

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Second Semester **Physics Group** **Contact Hrs. : 29**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCH101-18	Basic Science Course	Chemistry-I	3	1	0	40	60	100	4
BTCH102-18	Basic Science Course	Chemistry-I (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-II	3*	1	0	40	60	100	4
BTPS101-18	Engineering Science Course	Programming for Problem Solving	3	0	0	40	60	100	3
BTPS102-18	Engineering Science Course	Programming for Problem Solving (Lab)	0	0	4	30	20	50	2
BTMP101-18	Engineering Science Courses	Workshop / Manufacturing Practices	1	0	4	60	40	100	3
BTHU101-18	Humanities and Social Sciences including Management courses	English	2	0	0	40	60	100	2
BTHU102-18	Humanities and Social Sciences including Management courses	English (Lab)	0	0	2	30	20	50	1
BMPD201-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
	TOTAL		12	2	15	290	360	650	20.5

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

Second Semester **Chemistry Group** **Contact Hrs.: 24**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTPHXX-18	Basic Science Course	Physics	3	1	0	40	60	100	4
BTPHXX-18	Basic Science Course	Physics (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-II	3*	1	0	40	60	100	4
BTEE101-18	Engineering Science Course	Basic Electrical Engineering	3	1	0	40	60	100	4
BTEE102-18	Engineering Science Course	Basic Electrical Engineering (Lab)	0	0	2	30	20	50	1
BTME101-18	Engineering Science Courses	Engineering Graphics & Design	1	0	4	60	40	100	3
BMPD201-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
TOTAL			10	3	11	220	280	500	17.5

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

Note : 1. Mentoring and Professional Development will be offered as mandatory Non-Credit course. Mentoring and Professional Development course will have internal evaluation only.

2. This study scheme & syllabus is not applicable for B. Tech Chemical Engineering and B. Tech Petrochem & Petroleum Refinery Engineering. The study scheme and syllabus of B. Tech Chemical Engineering and B. Tech Petrochem & Petroleum Refinery Engineering is separately uploaded on University website.

3. There will be no external theory exam for subject code BTME101-18 (Engineering Graphics & Design) For detail evaluation scheme refer detailed syllabus (page no. 84)

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A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical(Lab)/week	0.5 credits 1 credit

B. Range of credits –

A range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

C. Structure of Undergraduate Engineering program:

S. No.	Category	Suggested Breakup of Credits(Total 160)
1	Humanities and Social Sciences including Management courses	12
2	Basic Science courses	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24
4	Professional core courses	48
5	Professional Elective courses relevant to chosen specialization/branch	18
6	Open subjects – Electives from other technical and /or emerging subjects	18
7	Project work, seminar and internship in industry or elsewhere	15
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	160

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Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

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Induction Programs

A Guide to Induction Program

Introduction

(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.[1] *This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help insti-tutions in understanding the spirit of the accepted Induction Program and implementing it.)*

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer envi-ronment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them

[1]A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs.

work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

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Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the insti-tution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature.[2]

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

Induction Program as described here borrows from three programs running earlier at diff erent insti-tutions: (1) Foundation Program running at IIT Gadhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsary course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high eff ectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member.

Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

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2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2.2 Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.[3]

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

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[3]The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

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2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept./Branch & Innovations

The students should be told about diff erent method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilties.

3.Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

Time	Activity
Day 0 Whole Day	Student arrive – Hostel allotment. (Preferably do pre-allotment)
Day-1 09:00 am- 03:00 pm 04:30 pm - 06:00 pm	 Academic Registration Orientation
Day-2 09:00 am - 10:00 am	 Diagnostic Test (for English etc.)
10:15am - 12:25 pm	Visit to respective depts..
12:30 pm - 01:55 pm	Lunch
02:00 pm -02:55 pm	Director's address
03:00 pm – 05:00 pm	Interaction with parents
03:30 pm – 05:00 pm	Mentor-mentee groups – introduction within group (Same as Universal Human Values groups)

3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

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3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Sessn.	*Time*	*Activity*	*Remarks*
	Day 3 onwards *06:00 am*	*Wake up call*	
I	06:30 am - 07:10 am	Physical activity (mild exercise/yoga)	
	07:15 am - 08:55 am	*Bath, Breakfast, etc.*	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	*Lunch*	
IV	02:30 pm - 03:55 pm	Afternoon Session	See below.
V	04:00 pm - 05:00 pm	Afternoon Session	See below.
	05:00 pm - 05:25 pm	*Break / light tea*	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	*Rest and Dinner*	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

3.2.2 Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept. / Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

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Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	*Session*	*Remarks*
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	For 3-5 days
Proficiency Modules	V	Daily, but only for those who need it

3.3 Closing Phase

Time	*Activity*
Last But One Day	
08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor-mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a *student guide*, and for every 20 students, there would be a *faculty mentor*.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline[4].

Here we list some important suggestions which have come up and which have been experimented with.

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3.4.1 Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

3.4.2 Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters.

It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta-skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing compe-tition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and

[4]We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept.

nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It

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also connects students with each other and with teachers, so that they can share any difficulty they might be facing and seek help.

References:

Motivating UG Students Towards Studies,

Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors), 31 March 2016, IIT Directors' Secretariat, IIT Delhi.

Contact: *Prof. Rajeev Sangal* Director, IIT(BHU), Varanasi, (director@iitbhu.ac.in)

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Semester 1st

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Bachelor of Technology (B. Tech. 1st Year)

S.No.	Branch	Related Branches	Course codes	Course title	Credits
1	Civil Engineering	1. Civil Engineering	BTPH101-18	Mechanics of solids	4
		2.Construction Engineering & Management	BTPH111-18	Mechanics of solids Lab	1.5
2	Electrical Engineering	1.Electrical Engineering	BTPH102-18	Optics and Modern Physics	4
		2.Automation & Robotics			
		3.Electrical & Electronics Engineering	BTPH112-18	Optics and Modern Physics Lab	1.5
		4.Electronics & Electrical Engineering			
		5.Electrical Engineering & Industrial Control			
		6.Instrumentation & Control Engineering			
3	Mechanical Engineering	1.Mechanical Engineering	BTPH103-18	Electromagnetism	4
		2.Marine Engineering			
		3.Production Engineering	BTPH113-18	Electromagnetism Lab	1.5
		4.Industrial Engineering			
		5.Tool Engineering			
		6.Automobile Engineering			
		7.Aerospace Engineering			
		8.Aeronautical Engineering			
4	Computer Science Engineering	1.Computer Engineering	BTPH104-18	Semi-Conductor Physics	4
		2.Computer Science Engineering			
		3.Information Technology	BTPH114-18	Semi-Conductor Physics Lab	1.5
		4.3D Animation Engineering			

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5	Electronics and communication Engineering	1.Electronics & Communication Engineering 2.Electronics & Computer Engineering 3.Electronics & Instrumentation Engineering 4.Electronics & Telecomm Engineering 5.Electronics Engineering	BTPH105-18 BTPH115-18	Introduction to Semi-Conductor Physics Semi-Conductor Physics Lab	4 1.5
6	Chemical Sciences	1.Chemical Engineering 2.Petrochem & Petroleum Refinery Engineering 3.Textile Engineering 4.Food Technology	BTPH106-18 BTPH116-18	Optics and Electromagnetism Optics and Electromagnetism Lab	4 1.5
7	Bio-Technology	Bio-Technology	BTPH107-18 BTPH117-18	Introduction to Physics: Biotechnology Physics Lab	4 1.5

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BTPH101-18	Mechanics of Solids	L-3, T-1, P-0	4 Credits

Pre-requisites (if any):

(i) High-school education with Physics as one.of the subject

Course Objectives: The aim and objective of the course on **Mechanics of Solids** is to introduce the students of B. Tech. to the formal structure of vector mechanics, harmonic oscillators, and mechanics of solids so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the vector mechanics for a classical system.
CO2	Identify various types of forces in nature, frames of references, and conservation laws.
CO3	Know the Newton's equations of motion in polar, cylindrical and spherical coordinated.
CO4	Apply the knowledge obtained in this course to related problems such as weather systems, Foucault pendulum; Harmonic oscillator, etc.
CO5	Analyze the planar rigid body dynamics of the 2-Dimensional and 3-Dimensional system.

Detailed Syllabus:
PART-A
Module 1: Vector mechanics of particles

Physical significance of gradient, Divergence and curl. Potential energy function; F = - Grad V, equipotential surfaces. Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law. Introduction to Cartesian, spherical and cylindrical coordinate system. Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits. Non-inertial frames of reference; Rotating coordinate system: - Centripetal and Coriolis accelerations; Foucault pendulum.

Module 2: Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators, damped oscillations, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, resonance.

PART-B

Module 3: Planar rigid body Mechanics

Definition and motion of a rigid body in the plane; Rotation in the plane, Angular momentum about a point of a rigid body in planar motion; centre of mass, moment of inertia, moment of theorems of moment of inertia, inertia of plane lamina, circular ring, moment of force, couple, Euler's laws of motion. Introduction to three-dimensional rigid body motion.

Module 4: Mechanics of solids

Friction: Definitions: Types of friction, Laws of static friction, Limiting friction, Angle of friction, angle of repose; motion on horizontal and inclined planes. Methods of reducing friction, Concept of stress and strain at a point; Concepts of elasticity, plasticity, strain hardening, failure (fracture / yielding), one dimensional stress-strain curve; Generalized Hooke's law. Force analysis — axial force, shear force, bending moment and twisting moment. Bending stress; Shear stress; Concept of strain energy; Yield criteria.

Reference books:

1. Engineering Mechanics, 2nd ed. - MK Harbola
2. Introduction to Mechanics - MK Verma
3. An Introduction to Mechanics - D Kleppner & R Kolenkow
4. Principles of Mechanics - JL Synge & BA Gri ths
5. Mechanics - JP Den Hartog
6. Engineering Mechanics- Dynamics, 7th ed. - JL Meriam
7. Mechanics Vibrations - JP Den Hartog
8. Theory of Vibrations with Applications — WT Thomson
9. An Introduction to the Mechanics of Solids, 2nd ed. with SI Units-SH Crandall, NC Dahl & TJ Lardner
10. Classical Mechanics: H. Goldstein, Pearson Education Asia.
11. Classical mechanics of particles and rigid bodies: K.C Gupta, Wiley eastern New Delhi.
12. Engineering Mechanics: Statics, 7th ed.-JL Meriam
13. Modern's Analytical Mechanics, Satish K Gupta

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BTPH111-18	Mechanics of Solids Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisites (if any):

(i) High-school education with Physics as one of the subject

Course Objectives: The aim and objective of the Lab course on **Mechanics of Solids** is to introduce the students of B. Tech to the formal structure of Mechanics of solids so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be

CO1	Able to understand the concepts learned in the mechanics of solids.
CO2	Learning the skills needed to verify some of the concepts of theory courses.
CO3	Trained in carrying out precise measurements and handling sensitive equipment.
CO4	Able to understand the principles of error analysis and develop skills in experimental design.
CO5	Able to document a technical report which communicates scientific information in a clear and concise manner.

Detailed syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list:

1. Measurements of length (or diameter) using vernier caliper, screw gauge, and travelling microscope. Use of Plumb line and Spirit level.
2. To determine the horizontal distance between two points using a Sextant.
3. To determine the vertical distance between two points using a Sextant.
4. To determine the height of an inaccessible object using a Sextant.
5. To determine the angular diameter of the sun using the sextant.
6. To determine the angular acceleration α, torque τ, and Moment of Inertia of flywheel.
7. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of **g** and (c) Modulus of rigidity.
8. To determine the time period of a simple pendulum for different length and acceleration due to gravity.
9. To study the variation of time period with distance between centre of suspension and centre of gravity for a compound pendulum and to determine: (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of g in the laboratory.
10. To determine the Young's Modulus of a Wire by Optical Lever Method.
11. To determine the Elastic Constants/Young's Modulus of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
13. To determine the Modulus of Rigidity of brass using Searle's method.
14. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
15. To determine **g** by Kater's Pendulum.
16. To determine **g** and velocity for a freely falling body using Digital Timing Technique.

Mechanics virtual lab:

17. To determine the angular acceleration α and torque τ of flywheel.
18. To determine the moment of inertia of a flywheel.
19. To find the acceleration of the cart in the simulator.
20. To find the distance covered by the cart in the simulator in the given time interval.
21. To verify that energy conservation and momentum conservation can be used with a ballistic pendulum to determine the initial velocity of a projectile, its momentum and kinetic energy.
22. To verify the momentum and kinetic energy conservation using collision balls.
23. To understand the torsional oscillation of pendulum in different liquid. and determine the rigidity modulus of the suspension wire using torsion pendulum.
24. To find the Time of flight, Horizontal range and maximum height of a projectile for different velocity, angle of projection, cannon height and environment.
25. The Elastic and Inelastic collision simulation will help to analyse the collision variations for different situations.
26. Demonstration of collision behaviour for elastic and inelastic type.
27. Variation of collision behavior in elastic and inelastic type.
28. Study of variation of Momentum, Kinetic energy, Velocity of collision of the objects and the Center of Mass with different velocity and mass.
29. Calculation of the Momentum, Kinetic energy, and Velocity after collision.

Suggested Reading

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4^{th} Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11^{th} Edn, 2011, Kitab Mahal
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4^{th} Edition, Cambridge University Press.
6. http://vlab.amrita.edu/index.php?sub=1

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BTPH102-18	Optics and Modern Physics	L-3, T-1, P-0	4 Credits

Pre-requisite (if any):

(i) High-school education with physics as one of the subject

Course Objectives: The aim and objective of the course on **Optics and Modern Physics** is to introduce the students of B.Tech. to the subjects of wave optics, Quantum Mechanics, Solids, and Semiconductors so that they can use these in **Engineering** as per their requirement.

Course **Outcomes:** At the end of the course, the student will be able to

CO1	Identify and illustrate physical concepts and terminology used in optics and other wave phenomena.
CO2	Understand optical phenomena such as polarization, birefringence, interference and diffraction in terms of the wave model.
CO3	Understand the importance of wave equation in nature and appreciate the mathematical formulation of the same
CO4	Appreciate the need for quantum mechanics, wave particle duality, uncertainty principle etc.
CO5	Understand some of the basic concepts in the physics of Solids and Semiconductors.

Detailed Syllabus:
PART-A

Module 1: Waves (3 hours)

Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator

Module 2: Non-dispersive transverse and longitudinal waves (4 hours)

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves

Module 3: Light and Optics (3 hours)

Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave, Mirrors and lenses and optical instruments based on them.

Module 4: Wave Optics (5 hours)

Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

PART-B

Module 5: Lasers (5 hours)

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity

Module 6: Introduction to Quantum Mechanics (5 hours)

Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

Module 7: Solution of Wave Equation (6 hours)

Solution of stationary-state Schrodinger equation for one dimensional problems–particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator. Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope, tunneling in semiconductor structures. Three-dimensional problems: particle in three dimensional box, and related examples.

Module 8: Introduction to Solids and Semiconductors (9 hours):

Free electron theory of metals, Fermi level, density of states in 1, 2 and 3 dimensions, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction.

Text/References:

1. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.
2. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
3. E. Hecht, "Optics", Pearson Education, 2008.
4. A. Ghatak, "Optics", McGraw Hill Education, 2012.
5. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
6. D. J. Griffiths, "Quantum mechanics", Pearson Education, 2014.
7. R. Robinett, "Quantum Mechanics", OUP Oxford, 2006.
8. D. McQuarrie, "Quantum Chemistry", University Science Books, 2007.
9. D.A. Neamen, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.
10. E.S. Yang, "Microelectronic Devices", McGraw Hill, Singapore, 1988.
11. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.

BTPH112-18	Optics and Modern Physics Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisite (If any): (i) High-school education with physics as one of the subject

Course Objectives: The aim and objective of the lab on **Optic and Modern Physics** is to introduce the students of B.Tech. class to the formal structure of wave and optics, Quantum Mechanics and semiconductor physics so that they can use these in Engineering branch as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic errors.
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: **Students are expected to perform about 10-12 experiments from the following list:**

1. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
2. Study of diffraction using laser beam and thus to determine the grating element.
3. To study laser interference using Michelson's Interferometer.
4. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
5. To determine attenuation & propagation losses in optical fibres.
6. To determine the grain size of a material using optical microscope.
7. To find the refractive index of a material/glass using spectrometer.
8. To find the refractive index of a liquid using spectrometer.
9. To find the velocity of ultrasound in liquid.
10. To determine the specific rotation of sugar using Laurent's half-shade polarimeter.
11. To study the characteristic of different p-n junction diode - Ge and Si.
12. To analyze the suitability of a given Zener diode as voltage regulator.
13. To find out the intensity response of a solar cell/Photo diode.
14. To find out the intensity response of a LED.

Virtual lab experiments:

15. To find the resolving power of the prism.
16. To determine the angle of the given prism.
17. To determine the refractive index of the material of a prism
18. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
19. To calculate the beam divergence and spot size of the given laser beam.
20. To determine the wavelength of a laser using the Michelson interferometer.
21. To revise the concept of interference of light waves in general and thin-film interference in particular.
22. To set up and observe Newton's rings.
23. To determine the wavelength of the given source.
24. To understand the phenomenon Photoelectric effect as a whole.
25. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
26. To determine the Planck's constant from kinetic energy versus frequency graph.
27. To plot a graph connecting photocurrent and applied potential.
28. To determine the stopping potential from the photocurrent versus applied potential graph.

BTPH103-18	Electromagnetism	L-3, T-1, P-0	4 Credits

Pre-requisites (If any): (i) High-school education with physics as one of the Subject

Course Objectives: The aim and objective of the course is to expose the students to the formal structure of electromagnetism so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Specify the constitutive relationships for fields and understand why they are important.
CO2	Describe the static and dynamic electric and magnetic fields for technologically important structures.
CO3	Measure the voltage induced by time varying magnetic flux.
CO4	acquire the knowledge of Maxwell equation and electromagnetic field theory and propagation and reception of electro-magnetic wave systems.
CO5	have a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies.

Detailed Syllabus:

PART-A

Module 1: Electrostatics in vacuum (8 lectures)

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Farady's cage and coffee-ring effect; Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.

Module 2: Electrostatics in a linear dielectric medium (4 lectures)

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

Module 3: Magnetostatics (6 lectures)

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Module 4: Magnetostatics in a linear magnetic medium (3 lectures)

Magnetization and associated bound currents; auxiliary magnetic field $\vec{H}$; Boundary conditions on $\vec{B}$ and $\vec{H}$. Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

PART-B

Module 5: Faraday's law (4 lectures)

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Module 6: Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations (5 lectures)

Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time-dependent electric field; calculating magnetic field due to changing electric fields in quasi-static approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields.

Module 7: Electromagnetic waves (8 lectures)

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

Suggested Text Books

(i) David Griffiths, Introduction to Electrodynamics

Suggested Reference Books:

(i) Halliday and Resnick, Physics
(ii) W. Saslow, Electricity, magnetism and light

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BTPH113-18	Electromagnetism Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisite (If any): (i) High-school education

Course Objectives: The aim and objective of the lab course on **Electromagnetism** is to introduce the students of B. Tech. class to the formal structure of electromagnetism so that they can use these in various branches of engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	understand the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the magnetic field of a circular coil carrying current.
3. To study B-H curve using CRO.
4. To find out the frequency of AC mains using electric-vibrator.
5. To find out polarizability of a dielectric substance.
6. Determine a high resistance by leakage method using Ballistic Galvanometer.
7. To study the Characteristics of a Series RC Circuit
8. To study the series LCR circuit and determine its (a) Resonant Frequency, (b) Quality.
9. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency (b) Quality factor Q.
10. To determine the value of self-inductance by Maxwell Inductance Bridge.
11. To determine the value of self-inductance by Maxwell Inductance Capacitance Bridge.
12. To determine the mutual inductance of two coils by Absolute method.
13. To study the induced emf as a function of the velocity of magnet and to study the phenomenon of electromagnetic damping.
14. To determine unknown capacitance by flashing and quenching method.
15. To study the field pattern of various modes inside a rectangular waveguide.
16. To determine charge to mass ratio (e/m) of an electron by helical method.
17. To determine charge to mass ratio (e/m) of an electron by Thomson method.
18. To determine dipole moment of an organic molecule acetone.
19. To find out the horizontal component of earth's magnetic field (B_h).

Virtual lab experiments:

20. To find out the horizontal component of earth's magnetic field (B_h).
21. An experiment to study the variation of magnetic field with distance along the axis of a circular coil carrying current.
22. Aim is to find the horizontal intensity of earth's magnetic field at a place and moment of the bar magnet.
23. To determine the self inductance of the coil (L) using Anderson's bridge.
24. To calculate the value of inductive reactance (X_L) of the coil at a particular frequency.
25. The temperature coefficient of resistor simulation will help the user to easily identify the change in resistivity of the resistor according to the change in temperature.
26. To find the inductance of a coil using Anderson's Bridge.

BTPH104-18	Semiconductor Physics	L-3, T-1, P-0	4 Credits

Prerequisite:

(i) "Introduction to Quantum Mechanics" Desirable

Course Objectives: The aim and objective of the course on **Semiconductor Physics** is to introduce the students of B. Tech. class to the formal structure of semiconductor physics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand and explain the fundamental principles and properties of electronic materials and semiconductors
CO2	Understand and describe the interaction of light with semiconductors in terms of fermi golden rule.
CO3	Understand and describe the impact of solid-state device capabilities and limitations on electronic circuit performance.
CO4	Understand the design, fabrication, and characterization techniques of Engineered semiconductor materials.
CO5	Develop the basic tools with which they can study and test the newly developed devices and other semiconductor applications.

Detailed Syllabus:

PART-A
Module 1: Electronic materials (8)

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

Module 2: Semiconductors (10)

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

PART-B

Module 3: Light-semiconductor interaction (6)

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

Module 4: Measurements (6)

Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, band gap by UV-Vis spectroscopy, absorption/transmission.

Module 5: Engineered semiconductor materials (6)

Density of states in 2D, 1D, and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Hetero junctions and associated band-diagrams.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press. New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL.
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.

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Bachelor of Technology (B. Tech. 1st Year)

BTPH114-18	Semiconductor Physics Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisite: (i) High-school education

Course Objectives: The aim and objective of the Lab course on **Semiconductor Physics** is to introduce the students of B.Tech. class to the formal structure of semiconductor physics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list:

1. To study the characteristic of different PN junction diode-Ge and Si.
2. To analyze the suitability of a given Zener diode as a power regulator.
3. To find out the intensity response of a solar cell/Photo diode.
4. To find out the intensity response of a LED.
5. To determine the band gap of a semiconductor.
6. To determine the resistivity of a semiconductor by four probe method.
7. To confirm the de Broglie equation for electrons.
8. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters.
9. To study the magnetic field of a circular coil carrying current.
10. To find out polarizability of a dielectric substance.
11. To study B-H curve of a ferro-magnatic material using CRO.
12. To find out the frequency of AC mains using electric-vibrator.
13. To find the velocity of ultrasound in liquid.
14. To study the Hall effect for the determination of charge current densities.
15. Distinguish between Diamagnetic material, Paramagnetic and ferromagnetic material.
16. Measurement of susceptibility of a liquid or a solution by Quincke's method.
17. AFM experiment to study the sample with the nano-scale objects and measure surface topography with different scales, width and height of nano objects, and force-distance curves.
18. To study the temperature coefficient of Resistance of copper.
19. To determine the ratio k/e Using a transistor.
20. To compare various capacitance and verify the law of addition of capacitance.
21. To determine dipole moment of an organic molecule acetone.
22. To measure the temperature dependence of a ceramic capacitor.
23. Verification of the curie Weiss law for the electrical susceptibility of a ferromagnetic material.

Virtual lab experiments:

24. To draw the static current-voltage (I-V) characteristics of a junction diode.
25. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.
26. To determine the resistivity of semiconductors by Four Probe Method.
27. To study Zener diode voltage as regulator and measure its line and load regulation.
28. To study the B-H Curve.
29. To study the Hall effect experiment to determine the charge carrier density.
30. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.
31. To study the phenomena of magnetic hysteresis and calculate the retentivity, coercivity and saturation magnetization of a material using a hysteresis loop tracer.
32. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.

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BTPH105-18	**Introduction to Semiconductor Physics**	**L-3, T-1, P-0**	**4 Credits**

Prerequisite:

(ii) "Introduction to Quantum Mechanics" Desirable

Course Objectives: The aim and objective of the course on **Introduction to Semiconductor Physics** is to introduce the students of B. Tech. class to the formal structure of semiconductor physics and Optoelectronics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand and explain the fundamental principles and properties of electronic materials and semiconductors.
CO2	Understand and describe the interaction of light with semiconductors in terms of fermi golden rule.
CO3	Understand and describe the impact of solid-state device capabilities and limitations on electronic circuit performance.
CO4	Understand the design, fabrication, characterization techniques, and measurements of Engineered semiconductor materials.
CO5	Learn the basics of the optoelectronic devices, LEDs, semiconductor lasers, and photo detectors.

Detailed Syllabus:
PART-A

Module 1: Electronic materials

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors and insulators, Effective mass of electron and hole.

Module 2: Semiconductors

Intrinsic and extrinsic semiconductors, Fermi level and Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky)

PART-B

Module 3: Optoelectronic devices

Radiative and non-radiative recombination mechanisms in semiconductors, Semiconductor materials of interest for optoelectronic devices.

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Semiconductor light emitting diodes (LEDs): light emitting materials, device structure, characteristics, Fiber optic communication,

Semiconductor lasers: Lasers, Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Semiconductor laser: population inversion at a junction, structure, materials, device characteristics, vertical-cavity surface-emitting lasers (VECSEL), Tunable semiconductor lasers.

Photodetectors: Types of semiconductor photo detectors -p-n junction, PIN, and Avalanche-and their structure, materials, working principle, and characteristics, Noise limits on performance; Solar cells.

Introduction to Low-dimensional optoelectronic devices viz. Quantum-well, -wire, and -dot based LEDs, lasers, and photodetectors.

Module 4: Measurements: Four-point probe and vander Pauw measurements for resistivity, and hall mobility and electronic energy band gap; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, optical band gap by UV-Vis spectroscopy, absorption/transmission.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL.
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.
8. Solid state electronics devices by Ben. G. Streetman Pearson Prentice Hall.

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BTPH115-18	**Semiconductor Physics Lab**	**L-0, T-0, P-3**	**1.5 Credits**

Pre-requisite:

(i) High-school education

Course Objectives: The aim and objective of the Lab course on **Semiconductor Physics** is to introduce the students of B.Tech. class to the formal lab structure of semiconductor physics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list:

1. To study the characteristic of different PN junction diode-Ge and Si.
2. To analyze the suitability of a given Zener diode as a power regulator.
3. To find out the intensity response of a solar cell/Photo diode.
4. To find out the intensity response of a LED.
5. To determine the band gap of a semiconductor.
6. To determine the resistivity of a semiconductor by four probe method.
7. To confirm the de Broglie equation for electrons.
8. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters.
9. To study the magnetic field of a circular coil carrying current.
10. To find out polarizability of a dielectric substance.
11. To study B-H curve of a ferro-magnatic material using CRO.
12. To find out the frequency of AC mains using electric-vibrator.
13. To find the velocity of ultrasound in liquid.
14. To study the Hall effect for the determination of charge current densities.
15. Distinguish between Diamagnetic material, Paramagnetic and ferromagnetic material.
16. Measurement of susceptibility of a liquid or a solution by Quincke's method:
17. AFM experiment to study the sample with the nano-scale objects and measure surface topography with different scales, width and height of nano objects, and force-distance curves.
18. To study the temperature coefficient of Resistance of copper.
19. To determine the ratio k/e Using a transistor.
20. To compare various capacitance and verify the law of addition of capacitance.
21. To measure the temperature dependence of a ceramic capacitor.
22. Verification of the curie Weiss law for the electrical susceptibility of a ferromagnetic material.

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Virtual lab:

23. To draw the static current-voltage (I-V) characteristics of a junction diode.
24. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.
25. To determine the resistivity of semiconductors by Four Probe Method.
26. To study Zener diode voltage as regulator and measure its line and load regulation.
27. To study the B-H Curve.
28. To study the Hall effect experiment to determine the charge carrier density.
29. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.
30. To study the phenomena of magnetic hysteresis and calculate the retentivity, coercivity and saturation magnetization of a material using a hysteresis loop tracer.
31. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.

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BTPH106-18	**Optics and Electromagnetism**	**L-3, T-1, P-0**	**4 Credits**

Prerequisite:

(i) "Introduction to Quantum Mechanics" Desirable

Course Objectives: The aim and objective of the course on **Optics and Electromagnetism** is to introduce the students of B.Tech. class to the basic concepts of optics and its applications, electricity and magnetism, and quantum physics, so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to understand

CO1	Identify and illustrate physical concepts and terminology used in optics and other wave phenomena.
CO2	Understand optical phenomena such as polarization, birefringence, interference and diffraction in terms of the wave model.
CO3	Understand the importance of wave equation in nature and appreciate the mathematical formulation of the same
CO4	Acquire knowledge about the Maxwell equation and magnetic properties of materials.
CO5	Appreciate the need for quantum mechanics, wave particle duality, uncertainty principle etc.

Detailed syllabus:

PART-A

Module1: Optics and Fibre Optics (12L + 4T)

- **Diffraction:** Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications.

- **Polarisation:** Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity.

- **Fibre Optics:** Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres.

- **Lasers:** Introduction to interaction of radiation with matter, principles and working of a laser: population inversion, pumping, various modes, threshold population inversion, types of laser: solid state, semiconductor, gas; application of lasers.

PART-B

Module 2: Electromagnetism and Magnetic Properties of Materials (15L + 5T)

- Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's Faraday's laws. Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation, applications of dielectrics.

- Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

Module 3: Quantum Mechanics (18L + 6T)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

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BTPH116-18	Optics and Electromagnetism Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisite (if any):

(i) High-school education

Course Objectives: The aim and objective of the lab on Optics and Electromagnetism is to provide students the firsthand experience of verifying various theoretical concepts learnt in theory courses so that they can use these in their branch of Engineering as per their requirement.

Laboratory Outcomes: At the end of the course, students will be

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list:

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.
3. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
4. To study laser interference using Michelson's Interferometer.
5. Study of diffraction using laser beam and thus to determine the grating element.
6. To determine numerical aperture of an optical fibre.
7. To determine attenuation & propagation losses in optical fibres.
8. To find out the frequency of AC mains using electric-vibrator.
9. To find the refractive index of a material using spectrometer.
10. To find the refractive index of a liquid.
11. To study B-H curve using CRO.
12. To find the velocity of ultrasound in liquid.
13. To determine the grain size of a material using optical microscope.
14. To study the characteristics of solar cell.
15. To study the Characteristics of Light Emitting Diode (LED).
16. To determine the energy gap of a given semi-conductor.
17. To determine the specific rotation of sugar using Laurent's half-shade polarimeter.

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Virtual lab experiments:

18. To find the resolving power of the prism.
19. To determine the angle of the given prism.
20. To determine the refractive index of the material of a prism.
21. To find the numerical aperture of a given optic fibre and hence to find its acceptance angle.
22. To calculate the beam divergence and spot size of the given laser beam.
23. To determine the wavelength of a laser using the Michelson interferometer.
24. To revise the concept of interference of light waves in general and thin-film interference in particular.
25. To set up and observe Newton's rings.
26. To determine the wavelength of the given source.
27. To understand the phenomenon Photoelectric effect as a whole.
28. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
29. To determine the Planck's constant from kinetic energy versus frequency graph.
30. To plot a graph connecting photocurrent and applied potential
31. To determine the stopping potential from the photocurrent versus applied potential graph.

Reference Books:

1. "Fundamentals of Physics", 6th Ed., D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, Inc., New York, 2001.
2. "Physics", M. Alonso and E.J. Finn, Addison Wesley, .1992.
3. "Fundamentals of Optics", 4th Ed., F.A. Jenkins and H.E. White, McGraw-Hill Book Co., 1981.
4. "Optics", A Ghatak, Tata-McGraw Hill, New Delhi, 1992
5. "Vibration and Waves", A.P. French, Arnold-Heinemann, New Delhi, 1972.
6. "Students Reference Manual for Electronic Instrumentation Laboratories",
7. "Laboratory Experiments in College Physics", C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
8. Practical Physics", G.L. Squires, Cambridge University Press, Cambridge, 1985.
9. Experiments in Modern Physics", A.C. Melissinos, Academic Press, N.Y., 1966.
10. Practical Physics, by C L Arora. S. Chand & Company LTD.
11. http://vlab.amrita.edu/index.php?sub=1

BTPH107-18	Introduction to Physics in Biotechnology	L-3, T-1, P-0	4 Credits

Prerequisite:

(i) High School knowledge

Course Objectives: The aim and objective of the course on Introduction to Physics in Biotechnology is to introduce the students of B. Tech. class to the basic concepts and applications of Lasers, fibre optics, X-rays, magnetic material, superconductivity and a brief introduction to quantum physics, so that they can use these in Engineering as per their requirement.

Course **Outcomes:** At the end of the course, the student will be able to

CO1	Identify and illustrate physical concepts and terminology used in Lasers, fibre optics and other wave phenomena.
CO2	Understand the X-Rays and their applications to the ultrasounds.
CO3	Understand the importance of wave equation in nature and appreciate the mathematical formulation of the same
CO4	Appreciate the need for quantum mechanics, wave particle duality, uncertainty principle etc.
CO5	Understand the properties of magnetic materials and superconductivity.

Detailed Syllabus:

PART-A

Module 1: Lasers and Fibre Optics

Lasers: Principles and working of laser: population inversion, pumping, threshold population inversion, types of laser: solid state (Ruby), semiconductor, gas (He-Ne); application of lasers (Medical Applications, Industrial Applications).

Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, step and graded index fibres, numerical aperture and various fibre parameters, losses associated with optical fibres, application of optical fibres (various types of sensors and endoscopes).

Module 2: X-rays and Ultrasounds

X-rays: X-rays, Production of X-rays, Continuous and Characteristic X-Rays, Absorption of X-rays, Bragg's law, Adverse effects of X-rays, X-ray radiography.

Ultrasounds: Ultra sound generators, properties of ultrasound- waves and its propagation in biological tissues, Pulse echo techniques, Doppler principle, involvement in design of medical instruments, Adverse effects of ultrasound waves.

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PART-B

Module 3: Magnetic Materials and Superconductivity

Magnetic Materials: Origin of magnetism, Basic idea of Diamagnetic, Paramagnetic, Ferromagnetic, Ferrimagnetic and Ferrite materials, Soft and Hard Magnetic materials, applications of magnetic materials.

Superconductivity: Superconductivity, Signatures of Superconducting state, Meissner Effect, Type-I and Type-II superconductors, SQUIDS and its applications in medical industry.

Module 4: Quantum Theory and Low-dimensional Materials

Quantum Theory: Review of Photoelectric effect, Compton effect and de-Broglie waves; Wave- particle duality, Electron microscopy.

Low-dimensional Materials: Nanoscale, surface to volume ratio, electron confinement, confinement dimensions, Qualitative idea of quantum well, quantum wire and quantum dot. Carbon nanotubes: types, properties and applications.

Reference Books:

1. Engineering Physics, Malik; HK, Singh; AK, Tata McGraw Hill,
2. Concepts of Modern Physics, Beiser; A., Tata McGraw Hill.
3. Introduction to Solids, Azaroff LV, Tata Mc Graw Hill.
4. Engineering Physics, D.K. Bhattacharya, Poonam Tondon, Oxford University Press.
5. Optical Fibre system, Technology, Design & Applications, Kao; CK, McGraw Hill.
6. Laser Theory & Applications, Thygrajan; K, Ghatak; AK, Mc Millan India Ltd.

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BTPH117-18	**Physics lab**	**L-0, T-0, P-3**	**1.5 Credits**

Pre-requisite (if any):

(i) High-school education

Course Objectives: The aim and objective of the Physics lab is to provide students the firsthand experience of verifying various theoretical concepts learnt in theory courses so that they can use these in Engineering as per their requirement.

Laboratory Outcomes: At the end of the course, students will be

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic errors.
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list:

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.
3. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
4. To study laser interference using Michelson's Interferometer.
5. Study of diffraction using laser beam and thus to determine the grating element.
6. To determine numerical aperture of an optical fibre.
7. To determine attenuation & propagation losses in optical fibres.
8. To find out the frequency of AC mains using electric-vibrator.
9. To find the refractive index of a material using spectrometer.
10. To find the refractive index of a liquid.
11. To study B-H curve using CRO.
12. To find the velocity of ultrasound in liquid.
13. To determine the grain size of a material using optical microscope.
14. To study the characteristics of solar cell.
15. To study the Characteristics of Light Emitting Diode (LED).
16. To determine the energy gap of a given semi-conductor.
17. To determine the specific rotation of sugar using Laurent's half-shade polarimeter.

Virtual lab experiments:

18. To find the resolving power of the prism.
19. To determine the angle of the given prism.
20. To determine the refractive index of the material of a prism.

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21. To find the numerical aperture of a given optic fibre and hence to find its acceptance angle.
22. To calculate the beam divergence and spot size of the given laser beam.
23. To determine the wavelength of a laser using the Michelson interferometer.
24. To revise the concept of interference of light waves in general and thin-film interference in particular.
25. To set up and observe Newton's rings.
26. To determine the wavelength of the given source.
27. To understand the phenomenon Photoelectric effect as a whole.
28. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
29. To determine the Planck's constant from kinetic energy versus frequency graph.
30. To plot a graph connecting photocurrent and applied potential
31. To determine the stopping potential from the photocurrent versus applied potential graph.

Reference Books:

1. "Fundamentals of Physics", 6th Ed., D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, Inc., New York, 2001.
2. "Physics", M. Alonso and E.J. Finn, Addison Wesley, .1992.
3. "Fundamentals of Optics", 4th Ed., F.A. Jenkins and H.E. White, McGraw-Hill Book Co., 1981.
4. "Optics", A Ghatak, Tata-McGraw Hill, New Delhi, 1992
5. "Vibration and Waves", A.P. French, Arnold-Heinemann, New Delhi, 1972.
6. "Students Reference Manual for Electronic Instrumentation Laboratories",
7. "Laboratory Experiments in College Physics", C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
8. Practical Physics", G.L. Squires, Cambridge University Press, Cambridge, 1985.
9. Experiments in Modern Physics", A.C. Melissinos, Academic Press, N.Y., 1966.
10. Practical Physics, by C L Arora. S. Chand & Company LTD.
11. http://vlab.amrita.edu/index.php?sub=1

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Bachelor of Technology (B. Tech. 1st Year)

S.No.	Branch	Related Branches	Course codes	Course title	Credits
1	Civil Engineering-I Sem	1. Civil Engineering 2.Construction Engineering & Management	BTAM101-18	Mathematics-I	5
	Civil Engineering-II Sem	1. Civil Engineering 2.Construction Engineering & Management	BTAM201-18	Mathematics-II	5
2	Electrical Engineering-I Sem	1.Electrical Engineering 2.Automation & Robotics 3.Electrical & Electronics Engineering 4.Electronics & Electrical Engineering 5.Electrical Engineering & Industrial Control 6.Instrumentation & Control Engineering	BTAM102-18	Mathematics-I	5
	Electrical Engineering-II Sem	1.Electrical Engineering 2.Automation & Robotics 3.Electrical & Electronics Engineering 4.Electronics & Electrical Engineering 5.Electrical Engineering & Industrial Control 6.Instrumentation & Control Engineering	BTAM202-18	Mathematics-II	5

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3	Mechanical Engineering-I Sem	1.Mechanical Engineering 2.Marine Engineering 3.Production Engineering 4.Industrial Engineering 5.Tool Engineering 6.Automobile Engineering 7.Aerospace Engineering 8.Aeronautical Engineering	BTAM103-18	Mathematics-I	5
	Mechanical Engineering-II Sem	1.Mechanical Engineering 2.Marine Engineering 3.Production Engineering 4.Industrial Engineering 5.Tool Engineering 6.Automobile Engineering 7.Aerospace Engineering 8.Aeronautical Engineering	BTAM203-18	Mathematics-II	5
4	Computer Science Engineering-I Sem	1.Computer Engineering 2.Computer Science Engineering 3.Information Technology 4.3D Animation Engineering	BTAM104-18	Mathematics Paper-I	5
	Computer Science Engineering-II Sem	1.Computer Engineering 2.Computer Science Engineering 3.Information Technology 4.3D Animation Engineering	BTAM204-18	Mathematics Paper-II	5

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5	Electronics and communication Engineering-I Sem	1.Electronics & Communication Engineering	BTAM105-18	Mathematics-I	5
		2.Electronics & Computer Engineering			
		3.Electronics & Instrumentation Engineering			
		4.Electronics & Telecomm Engineering			
		5.Electronics Engineering			
	Electronics and communication Engineering-II Sem	1.Electronics & Communication Engineering	BTAM205-18	Mathematics-II	5
		2.Electronics & Computer Engineering			
		3.Electronics & Instrumentation Engineering			
		4.Electronics & Telecomm Engineering			
		5.Electronics Engineering			
6	Chemical Sciences-I Sem	1.Chemical Engineering	BTAM106-18	Mathematics-I	5
		2.Petrochem & Petroleum Refinery Engineering			
		3.Textile Engineering			
		4.Food Technology			
	Chemical Sciences-II Sem	1.Chemical Engineering	BTAM206-18	Mathematics-II	5
		2.Petrochem & Petroleum Refinery Engineering			
		3.Textile Engineering			
		4.Food Technology			

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7	Bio-Technology- I Sem	Bio-Technology	BTAM107-18	Basic Mathematics-I	5
	Bio-Technology- II Sem	Bio-Technology	BTAM207-18	Basic Mathematics-II	5

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Branch/Course: CIVIL ENGINEERING

BTAM101-18	**Mathematics-I** **(Calculus, Multivariable Calculus & Linear Algebra)**	**3L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 2a: *Calculus:* (6 hours)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2b: *Calculus:* (6 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 2c: *Sequences and series:* (Prerequisite 2b) (10 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Multivariable Calculus

Module 3a: ***Multivariable Calculus (Differentiation)*** (Prerequisite 2b) (10 hours)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 3b: ***Multivariable Calculus (Integration)*** (Prerequisite 3a) (10 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

Textbooks/References books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Matrices and Linear Algebra

Module 4a: ***Matrices (in case vector spaces is not to be taught)*** (14 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Text books/References:

1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition,

Course Outcomes: The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

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BTAM201-18	**Mathematics-II** **(Differential equations)**	**3L:1T:0P**	**4 credits**

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Detailed Contents:

(Prerequisite Sections 2 and 3)

Module 5a: ***First order ordinary differential equations*** (6 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 5b: *Ordinary differential equations of higher orders* (Prerequisite 2c, 4a) (8 hours) Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Textbooks/References:

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.

S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

Module 5c: *Partial Differential Equations – First order* (Prerequisite 5a-b) (6 hours) First order partial differential equations, solutions of first order linear and non-linear PDEs.

Module 5d: ***Partial Differential Equations*** – **Higher order** (Prerequisite 5b-c) (10 hours) Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

Textbooks/References:

S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.

R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.

Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.

Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.

Course Outcomes: The students will learn:

- The mathematical tools needed in evaluating multiple integrals and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

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Bachelor of Technology (B. Tech. 1st Year)
Complex Variables (Prerequisite 2a-c)

Course Objectives: *The main objective of this course is* to introduce and developing a clear understanding of the fundamental concepts of Complex Analysis such as analytic functions, Cauchy-Riemann relations and harmonic functions etc. and to make students equipped with the understanding of the fundamental concepts of complex variable theory.

Detailed Contents:

Module 6a: *Complex Variable – Differentiation* (Prerequisite 2a-c) (8 hours): Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 6b: *Complex Variable – Integration* (Prerequisite 6a) (8 hours):

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Module 6c: *Applications of complex integration by residues*: (Prerequisite 2a, 6b) (4 hours) Evaluation of definite integral involving sine and cosine. Evaluation of certain improper integrals using the Bromwich contour.

Textbooks/References:

Erwin kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.

J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Course Outcomes: After the completion of this course the student will be able to

- represent complex numbers algebraically and geometrically.
- Evaluate Complex integrals and applying Cauchy integral.
- evaluate limits and checking the continuity of complex function & apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and
  entire functions including the fundamental theorem of algebra.

Numerical Methods

Course Objective: The objective of this course includes the study the basic numerical methods and their convergence properties for solving nonlinear equations, linear system of equations, initial value problems and boundary value problems and the study of numerical methods for differentiation and integration.

Detailed Contents:

Module 7a: *Numerical Methods – 1* (Prerequisite 2a) (12 hours)

Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Module 7b: *Numerical Methods – 2* (Prerequisite 7a, 5a-d) (10 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods.

Partial differential equations: Finite difference solution two-dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Textbooks/References:

P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.

S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.

Course Outcomes: the student will be able to:

- apply the numerical methods (such as Bisection, False position, Newton-Raphson, Secant, to solve equations.
- apply the numerical methods (such as Gauss Elimination, Gauss Jordan, LU factorization, Cholesky Factorization, Jacobi and Gauss Seidel) for linear system of equations.
- apply the numerical methods (such as Newton forward and backward difference interpolation formula- Lagrange interpolation formula) for differentiation and integration.

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Branch/Course: ELECTRICAL ENGINEERING

BTAM102-18	**Mathematics-I** **(Calculus & Differential Equations)**	**3L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and differential equations. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 1: Calculus (8 hours)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 2: Sequences and Series (7 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 3: Multivariable Calculus: Differentiation (6 hours)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 4: Multivariable Calculus: Integration (7 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

Module 5: First Order Ordinary Differential Equations (3 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 6: Ordinary Differential Equations of Higher Order (6 hours)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 7: Partial Differential Equations: First Order (3 hours)

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Text / References:

G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", Pearson, 2002.

T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.

B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill, New Delhi, 2010.

N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.

W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.

S. L. Ross, "Differential Equations", Wiley India, 1984.

E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.

E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.

Course Outcomes: The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

BTAM202-18	**Mathematics-II** **(Linear Algebra, Transform Calculus & Numerical Methods)**	**3L:1T:0P**	**4credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in linear algebra, transform calculus and numerical methods. It aims to equip the students with standard concepts and tools of integral transforms, matrices and numerical techniques that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 1: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Module 2: Numerical Methods-I (10 hours)

Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Module 3: Numerical Methods-II (10 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two-dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Module 4: Transform Calculus (10 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier transforms.

Text / References:

D. Poole, "Linear Algebra: A Modern Introduction", Brooks/Cole, 2005.

N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.

V. Krishnamurthy, V. P. Mainra and J. L. Arora, "An introduction to Linear Algebra", Affiliated East-West press, 2005.

Course Outcomes: Students will be able to:

- demonstrate knowledge of a range of applications of these methods
- understand how integral transforms can be used to solve a variety of differential equations
- develop their attitude towards problem solving.
- Understand how to apply numerical methods to solve the mathematical models.

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Bachelor of Technology (B. Tech. 1st Year)
Branch/Course: MECHANICAL ENGINEERING

BTAM103-18	**Mathematics-I** **(Calculus & Linear Algebra)**	**3L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 1: Calculus: (6 lectures)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 lectures)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Sequences and series: (10 lectures)

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Multivariable Calculus (Differentiation): (8 lectures)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 5: Matrices (10 lectures)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

T. Veerarajan, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes: The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

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BTAM203-18	MATHEMATICS II (Calculus, Ordinary Differential Equations and Complex Variable)	3L:1T:0P	1 credits

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, Ordinary differential equations and Complex analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 1: Multivariable Calculus (Integration): (10 lectures)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 2: First order ordinary differential equations: (6 lectures)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 3: Ordinary differential equations of higher orders: (8 lectures)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 4: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 5: Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes: The students will learn:

- The mathematical tools needed in evaluating multiple integrals and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Branch/Course: COMPUTER SCIENCE AND ENGINEERING

BTAM104-18	**Mathematics Paper-I** **(Calculus & Linear Algebra)**	**3L:1T:0P**	**4credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 1: Calculus: (6 lectures)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 lectures)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Matrices (in case vector spaces is to be taught) (8 lectures)

Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Module 4: Vector spaces (Prerequisite Module 3-Matrices) (10 hours)

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.

Module 5: Vector spaces (Prerequisite Module 3 –Matrices & Module-4 Vector spaces) (10 lectures)

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

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Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11^{th} Reprint, 2010.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

Course Outcomes: The students will be able

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions. The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

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BTA204-18	**Mathematics Paper-II** **(Probability & Statistics)**	**3L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Detailed Content:

Module 1: Basic Probability: *(12 lectures)*

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions: *(4 lectures)*

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Module 3: Bivariate Distributions: *(4 lectures)* Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 4: Basic Statistics: (8 lectures)

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Module 5: Applied Statistics: (8 lectures)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Module 6: Small samples: (4 lectures)

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Suggested Text/Reference Books

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).

S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

T. Veerarajan, Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Course Outcomes: The students will learn:

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties. The basic ideas of statistics including measures of central tendency, correlation and regression and the statistical methods of studying data samples.

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Branch/Course: ELECTRONICS & COMMUNICATION ENGINEERING

BTAM105-18	**Mathematics-I** **(Calculus & Ordinary Differential Equations)**	**3L:1T:0P**	**1 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and ordinary differential equations. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 1: Calculus (8 hours)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 2: Sequences and Series (7 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 3: Multivariable Calculus: Differentiation (6 hours)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 4: Multivariable Calculus: Integration (7 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

Module 5: First Order Ordinary Differential Equations (3 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 6: Ordinary Differential Equations of Higher Order (6 hours)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 7: Partial Differential Equations: First Order (3 hours)

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Text / References:

G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", Pearson, 2002.

T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.

B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill, New Delhi, 2010.

N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.

E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.

W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.

S. L. Ross, "Differential Equations", Wiley India, 1984.

E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.

E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.

G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.

Course Outcomes: The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

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BTAM205-18	**Mathematics-II** **(Linear Algebra, Transform Calculus & Numerical Methods)**	**3L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in linear algebra, transform calculus and numerical methods. It aims to equip the students with standard concepts and tools of integral transforms, matrices and numerical techniques that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Module 1: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Module 2: Numerical Methods-I (10 hours)

Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Module 3: Numerical Methods-II (10 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Module 4: Transform Calculus (10 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier transforms.

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Text / References:

D. Poole, "Linear Algebra: A Modern Introduction", Brooks/Cole, 2005.

N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.

V. Krishnamurthy, V. P. Mainra and J. L. Arora, "An introduction to Linear Algebra", Affiliated East-West press, 2005.

Course Outcomes: Students will be able to:

- demonstrate knowledge of a range of applications of these methods
- understand how integral transforms can be used to solve a variety of differential equations
- develop their attitude towards problem solving.
- Understand how to apply numerical methods to solve the mathematical models.

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Branch/Course: CHEMICAL ENGINEERING

BTAM106-18	Mathematics-I	3L:1T:0P	4 credits

Course Objectives: The objective of this course is to introduce matrices, vectors, linear system of equations, eigen values and eigen vectors. Vectors are basic to this course. We will learn to manipulate them algebraically and geometrically. They will help us simplify the statements of problems and theorems and to find solutions and proofs. Determinants measure volumes and areas.

Detailed Contents:

1. Linear Algebra: Matrices, Vectors, Determinants, Linear Systems (12L + 4T): Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination, Linear Independence. Rank of a Matrix. Vector Space, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Inverse of a Matrix. Gauss-Jordan Elimination

2. Linear Algebra: Matrix Eigenvalue Problems (9L + 3T):

Eigenvalues, Eigenvectors, Applications of Eigenvalue Problems, Symmetric, Skew-Symmetric, and Orthogonal Matrices

3. Vector Differential Calculus. Grad, Div, Curl (12L + 4T):

Vectors in 2-Space and 3-Space, Inner Product (Dot Product), Vector Product (Cross Product), Vector and Scalar Functions and Fields, Derivatives, Curves. Arc Length. Curvature, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.

4. Integral Calculus. Integral Theorems (12L + 4T):

Line Integrals, Path Independence of Line Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

Course Outcomes: The students will be able to

- Learn to manipulate how to use matrices to sole linear system of equations.
- Use vectors in various mathematical problems which arise in kinematics.

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BTAM206-18	**Mathematics-II**	**3L:1T:0P**	**4 Credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in integral transform and differential equations. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

1. **Transforms [6L + 2T]:**
Laplace Transforms, Fourier Series and Transforms

2. **First-Order ODEs [9L + 3T]:**
Basic Concepts, Solutions of Separable ODEs, Exact ODEs, Linear ODEs, Solving ODEs by Laplace Transforms

3. **Second-Order Linear ODEs [9L + 3T]:**
Homogeneous Linear ODEs of Second Order, Euler-Cauchy Equations, Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters

4. **Series Solutions of ODEs, Special Functions [12L + 4T]:**
Power Series Method, Legendre.'s Equation, Legendre Polynomials, Bessel's Equation, Bessel Functions, Sturm-Liouville Problems, Orthogonal Functions

5. **Partial Differential Equations (9L + 3T):**
Basic Concepts, Classification, Solution of PDEs: Separation of Variables, Fourier Series, Laplace Transforms

Text Books/ Reference Books:

D. Poole, "Linear Algebra: A Modern Introduction", Brooks/Cole, 2005.

N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.

V. Krishnamurthy, V. P. Mainra and J. L. Arora, "An introduction to Linear Algebra", Affiliated East-West press, 2005.

Course Outcomes: Students will be able to:

- demonstrate knowledge of a range of applications of these methods
- understand how integral transforms can be used to solve a variety of differential equations
- develop their attitude towards problem solving.
- Understand how to apply integral transforms to solve the mathematical models.

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BTAM107-18	Basic Mathematics-I	3L:1T:0P	4 Credits

Course Objectives: The objective of this course is to familiarize the students with the basic techniques of mathematics which are highly useful to solve simple problems. This introduction aims at making the students understand the basic concepts in mathematics.

Detailed Contents:

1. **Algebra:** Complex numbers, Solution of quadratic equations, Permutations and combinations, Binomial theorem for positive/negative index and its simple applications, Arithmetic and geometric progression.
2. **Trigonometry:** Review of trigonometric functions, Sum and product formulae for trigonometric functions, Trigonometric equations and sum - to - product formulae for trigonometric functions, Identities related to double angle formulae.
3. **Determinants and Matrices:** Matrices, Operations on matrices, Determinants and its properties, Singular and non-singular matrices, Adjoint and inverse of a matrix and its properties, Solution of system of linear equations using Cramer's rule and matrix method.
4. **Coordinate Geometry:** Rectangular coordinate system, Straight lines, Circles (in standard form only).
5. **Statistics:** Measure of dispersion: mean deviation, Variance and standard deviation of grouped/ungrouped data. Correlation and regression.

Text books/Reference Books:

1) Mathematics, A Text books (Parts I & II), NCERT, New Delhi 2011.

2) E. Kreyszig, Advanced Engineering Mathematics, John Wiley, 1999.

3) V.K. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Associated East West Press 2007.

4) S.L. Loney, The elements of Coordinate Geometry, Michigan Historical Reprint series, 2012.

5) P.L. Meyer, Introductory Probability and Statistical Applications, Addison Wesley 1970.

Course Outcomes: Students will be able to

- acquire knowledge of basic algebra, trigonometry, matrices, coordinate geometry etc.
- apply these concepts to solve complex mathematical problems
- analyze the data of any experiment statistically to extract meaningful result

BTAM207-18	Basic Mathematics-II	3L:1T:0P	4 credits

Course Objectives: The objective is to develop basic computing skills and application of quantitative required for biological studies and rationalization of experimental designs.

Detailed Contents:

1. **Differentiation:** Functions, Domain and range, Properties of standard functions (trigonometric, exponential and logarithmic) and their graphs, Limit, Continuity and Differentiability. Differentiation of standard functions (polynomials, trigonometric, inverse trigonometric exponentials and logarithmic), Product rule, Quotient rule, Chain rule, Applications of derivatives in graphing, Maximum and minimum of single variable function, Functions of several variables, Partial derivatives, Homogeneous functions, Maximum and minimum of several variable functions.
2. **Integration:** Integral as anti-derivative, Integration: by substitution, by parts and partial fractions, Definite integral and its properties, Double integrals, Areas of bounded regions and rectification.
3. **Differential Equations:** Order and degree, General and particular solution of differential equation, Techniques for solving first order ordinary differential equation and its applications to biological problems (population growth, radioactive decay).

Text books/Reference Books:

1. Mathematics, A Text books (Parts I & II), NCERT, New Delhi, 2011.

2. G.B. Thomas and R.L. Finney, Calculus and Analytical Geometry, Pearson Education, 10th ed., 2007.

3. E. Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley, 1999.

4. Shanti Narayan, Differential and Integral Calculus, S. Chand, 2005.

Course Outcomes: Students will be able:

- explain functions, related properties and determine their continuity and differentiability.
- apply derivatives in graphing and maxima and minima of single variable function.
- predict integration of function using by parts, by substitution and partial fraction methods and apply these to find areas of bounded regions and rectifications.
- learn methods to solve first order ordinary differential equations and apply it to biological problems

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Category	Engineering Science Course				
Course title	**Basic Electrical Engineering (Theory & Lab.)**				
Scheme and Credits	L	T	P	Credits	Semester –I/II
	3	1	2	5	
Pre-requisites (if any): Nil					

Course code: BTEE-101-18

Course Title: Basic Electrical Engineering **(4 credits)**

[L: 3; T:1; P : 0]

Internal Marks: 40 External Marks: 60 Total Marks: 100

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's and Norton's Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.

Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

(ii) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

(iii) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.

(iv) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

(v) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

i. To understand and analyze basic electric and magnetic circuits
ii. To study the working principles of electrical machines and power converters.
iii. To introduce the components of low voltage electrical installations

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Course code: BTEE-102-18
Course Title: Basic Electrical Engineering Laboratory **(1 credit)**

[L: 0; T:0; P : 2]
Internal Marks: 30 External Marks: 20 Total Marks: 50

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstrate of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Laboratory Outcomes

i. Get an exposure to common electrical components and their ratings.
ii. Make electrical connections by wires of appropriate ratings.
iii. Understand the usage of common electrical measuring instruments.
iv. Understand the basic characteristics of transformers and electrical machines.
v. Get an exposure to the working of power electronic converters.

S. No.	Suggested List of Experiments
1.	To verify Ohm's Law and its limitations.
2.	To verify Kirchhoff's Laws.
3.	To measure the resistance and inductance of a coil by ammeter-voltmeter method
4.	To find voltage-current relationship in a R-L series circuit and to determine the power factor of the circuit.
5.	To verify the voltage and current relations in star and delta connected systems.
6.	To measure power and power factor in a single- phase AC circuit.
7.	To verify series and parallel resonance in AC circuits.
8.	To observe the B-H loop of ferromagnetic core material on CRO.
9.	To use a bridge rectifier for full- wave rectification of AC supply and to determine the relationship between RMS and average values of the rectified voltage.
10.	To measure the minimum operating voltage, current drawn, power consumed, and the power factor of a fluorescent tube light.
11.	To connect measuring analog and digital instruments to measure current, voltage, power and power factor.
12.	To obtain the characteristics of a transistor under common base (CB) and common emitter (CE) configuration.
13.	To perform open- and short circuit tests on a single- phase transformer and calculate its efficiency.
14.	To start and reverse the direction of rotation of a (i) DC motor (ii) Induction motor
15.	Determining of voltage regulation of transformer by directly loading.
16.	Study of starters for (i) DC motor (ii) Induction motor

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IK Gujral Punjab Technical University
Bachelor of Technology (B. Tech. 1st Year)

Course code	BTME101-18				
Category	Engineering Science Courses				
Course title	Engineering Graphics & Design (Theory & Lab.)				
Scheme and Credits	L	T	P	Credits	Semester – I
	1	0	4	3	
Pre-requisites (if any)	-				
	Common to all branches				

Engineering Graphics & Design [A total of 10 lecture hours & 60 hours of lab.]
[[L : 1; T:0; P : 4 (3 credits)]

Detailed contents

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.
Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module 1: Introduction to Engineering Drawing covering,
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering,
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering,
those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4:Sections and Sectional Views of Right Angular Solids covering,
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering,

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation & CAD Drawing
consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions covering
applying dimensions to objects, applying annotations to drawings; Setting up and use of layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and User Manuals Course Outcomes

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

The student will learn :

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

Paper Title : Engineering Graphics & Design (Practical)

Course Assessment Methods

End Semester Assessment:

1. University Theory Exam: Nil
2. University Practical Exam: 40 Marks (Evaluation of Traditional Engineering Graphics part of 20 Marks should be based upon written test by External Practical Examiner & Evaluation of Computer Graphics part of 20 marks should be based upon lab performance using computer graphics software & viva voce by External Practical Examiner)

Internal Assessment:

1. 60 Marks (20 marks for day to day work, 20 marks for written test & 20 marks for internal viva voce)

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Semester 2nd

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Course code	BTCH101-18				
Category	Basic Science Course				
Course title	Chemistry-I (Theory)				
	Contents				
	(i) Chemistry-I (Concepts in chemistry for engineering)				
Scheme and Credits	L	T	P	Credits	Semester –II
	3	1	0	4	
Pre-requisites (if any)	-				

(i)Chemistry-I (Concepts in chemistry for engineering) [L : 3; T:1; P : 0 (4 credits)]

Detailed contents

(i) Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams.

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(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

(i) University chemistry, by B. H. Mahan
(ii) Chemistry: Principles and Applications, by M. J. Sienko and R.A. Plane
(iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(v) Physical Chemistry, by P. W. Atkins
(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Course code	BTCH102-18				
Category	Basic Science Course				
Course title	Chemistry-I (Lab.)				
	Contents				
	(ii) Chemistry Laboratory				
Scheme and Credits	L	T	P	Credits	Semester –II
	0	0	3	1.5	
Pre-requisites (if any)	-				

(ii)Chemistry Laboratory [L : 0; T:0 ; P : 3 (1.5 credits)]

Choice of 10-12 experiments from the following

- Determination of surface tension and viscosity
- Thin Layer Chromatography
- Ion exchange column for removal of hardness of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry-determination of redox potentials and emf
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscometers to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

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Course code	BTPS101-18				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving (Theory)**				
Scheme and Credits	L	T	P	**Credits**	Semester – II
	3	**0**	**0**	**3**	[The lab component should have one hour of tutorial followed or preceded by laboratory assignments.]
Pre-requisites (if any)	-				

(i)Programming for Problem Solving ([L : 3; T:0; P : 0 (3 credits)] [contact hrs : 40]

Detailed contents

Unit 1

Introduction to Programming **(4 lectures)**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) – **(1 lecture).**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2

Arithmetic expressions and precedence **(2 lectures)**
Conditional Branching and Loops **(6 lectures)**
Writing and evaluation of conditionals and consequent branching **(3 lectures)**
Iteration and loops **(3 lectures)**

Unit 3

Arrays **(6 lectures)**
Arrays (1-D, 2-D), Character arrays and Strings

Unit 4

Basic Algorithms **(6 lectures)**
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5

Function **(5 lectures)**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6

Recursion **(4 -5 lectures)**

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7

Structure **(4 lectures)**

Structures, Defining structures and Array of Structures

Unit 8

Pointers **(2 lectures)**

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9

File handling (only if time is available, otherwise should be done as part of the lab)

**Suggest
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Text
Books**

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Course Outcomes

The student will learn

To formulate simple algorithms for arithmetic and logical problems.
To translate the algorithms to programs (in C language).
To test and execute the programs and correct syntax and logical errors.
To implement conditional branching, iteration and recursion.
To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
To use arrays, pointers and structures to formulate algorithms and programs.
To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

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Course code	BTPS102-18				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving (Lab)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester – II
	0	**0**	**4**	**2**	[The lab component should have one hour of tutorial followed or preceded by laboratory assignments.]
Pre-requisites (if any)	-				

(ii) Laboratory - Programming for Problem Solving [L : 0; T:0 ; P : 4 (2credits)]
[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems
To translate given algorithms to a working and correct program
To be able to correct syntax errors as reported by the compilers
To be able to identify and correct logical errors encountered at run time
To be able to write iterative as well as recursive programs
To be able to represent data in arrays, strings and structures and manipulate them through a program
To be able to declare pointers of different types and use them in defining self referential structures.
To be able to create, read and write to and from simple text files.

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Course code	BTMP101-18				
Category	Engineering Science Courses				
Course title	Workshop/Manufacturing Practices (Theory & Lab.)				
Scheme and Credits	L	T	P	Credits	Semester-II
	1	0	4	3	
Pre-requisites (if any)	-				
	Common to all branches				

Workshop/Manufacturing Practices [[L : 1; T:0; P : 0 (1 credit)]
Lectures & videos: (10
hours)

Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical &Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., " Elements of Workshop Technology" , Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
(ii) Kalpakjian S. And Steven S. Schmid, " Manufacturing Engineering and Technology" , 4th edition, Pearson Education India Edition, 2002.
(iii) Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
(iv) Roy A. Lindberg, " Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
(v) Rao P.N., " Manufacturing Technology" , Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

(ii) Workshop Practice:(60 hours)[L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop (10 hours)
2. Fitting shop (8 hours)
3. Carpentry (6 hours)
4. Electrical & Electronics(8 hours)
5. Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs)
6. Casting (8 hours)
7. Smithy (6 hours)
8. Plastic moulding& Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

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BTHU-101-18 English 2L: 0T: 0P 2 credits

Course Outcomes:

- The objective of the course is to help the students become the independent users of English language.
- Students will acquire basic proficiency in reading & listening, comprehension, writing and speaking skills.
- Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.
- They will be able to converse fluently.
- They will be able to produce on their own clear and coherent texts.

Detailed contents

Unit-1 Vocabulary Building & Basic Writing Skills

- The concept of Word Formation
- Root words from foreign languages and their use in English
- Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- Synonyms, antonyms, and standard abbreviations.
- Sentence Structures
- Use of phrases and clauses in sentences
- Importance of proper punctuation
- Creating coherence
- Organizing principles of paragraphs in documents
- Techniques for writing precisely

Unit-2 Identifying Common Errors in Writing

- Subject-verb agreement
- Noun-pronoun agreement
- Misplaced modifiers
- Articles
- Prepositions
- Redundancies

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- Clichés

Unit-3 Mechanics of Writing

- Writing introduction and conclusion
- Describing
- Defining
- Classifying
- Providing examples or evidence

Unit-4 Writing Practices

- Comprehension
- Précis Writing
- Essay Writing
- Business Writing-Business letters, Business Emails, Report Writing, Resume/CV

Suggested Readings:

(i) *Practical English Usage*. Michael Swan. OUP. 1995.

(ii) *Remedial English Grammar*. F.T. Wood. Macmillan.2007

(iii) *On Writing Well*. William Zinsser. Harper Resource Book. 2001

(iv) *Study Writing*. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

(v) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

(vi) *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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BTHU-102-18 (English Laboratory)

0L: 0T: 2P 1 credit

Course Outcomes:

- The objective of the course is to help the students become the independent users of English language.
- Students will acquire basic proficiency in listening and speaking skills.
- Students will be able to understand spoken English language, particularly the language of their chosen technical field.
- They will be able to converse fluently
- They will be able to produce on their own clear and coherent texts.

Detailed contents

Interactive practice sessions in Language Lab on Oral Communication

- Listening Comprehension
- Self-Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) *Practical English Usage*. Michael Swan. OUP. 1995.

(ii) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

(iii) *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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Syllabus (3^{rd}- 8^{th} Semester)

for

Undergraduate Degree Programme

Bachelor of Technology

ELECTRONICS AND COMMUNICATION ENGINEERING

Scheme & Syllabus

2018

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Structure of Distribution of credits Electronics & Communication Engineering Program as per AICTE Model Curriculum 2018:

Sr. No.	Category	Suggested Breakup of Credits (Total 160)
1	Humanities and Social Science including Management courses	12*
2	Basic Sciences courses	25*
3	Engineering Science courses-including workshop, drawing, basics of electrical/mechanical/computer etc.	24*
4	Professional Core courses	48*
5	Professional Elective courses relevant to chosen specialization/branch	18*
6	Open subjects - Electives from other technical and/or emerging subjects	18*
7	Project Work, Seminar and Internship in Industry or elsewhere	15*
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	160*

**Minor Variation is allowed as per need of the respective disciplines.*

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VISION

Imparting quality technical education and creation of skilled technocrats & innovative entrepreneurs to meet the global challenges in the society.

MISSION

To become a leading and unique department of higher learning by fostering the best teaching-learning environment supported by state-of-the-art infrastructure for practical realization of theoretical concepts and professional excellence. To impart outcome-based and continuously evolving curriculum by inculcating comprehensive domain knowledge to develop professional competence for meeting sustainable industrial and societal expectations. To inculcate human values and professional ethics amongst technocrats, researchers and entrepreneurs.

PROGRAMME EDUCATIONAL OBJECTIVES

1. Ability to generalize fundamental domain knowledge while working with electronic equipment/systems to handle engineering problems in professional career.
2. Ability to get profound knowledge of modern techniques, EDA tools and to acquire technical skills to innovate new/existing solutions to engineering problems.
3. Graduates will be known leaders in Electronics and Comm. Engineering and associated domains of engineering due their ability solve real-world inter-disciplinary problem.

PROGRAMME OUTCOMES (POs)

1. Working with Instruments: Appreciate working of electronic equipment/systems guided by practical experience and theoretical fundamental knowledge of Electronics & Communication Engineering.
2. Extrapolating Domain Knowledge: Ability to provide solutions to real-world problems in the field of Electronics & Communication Engineering by extrapolating the fundamental knowledge of electronic devices, circuits, embedded & communication systems.
3. Innovation and Design Ability: Innovative thinking and ability to design and/or improve products and/or systems for the society and industry for better utilization, human safety and reduced cost.

GRADUATE ATTRIBUTES (GAs)

1. Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. Problem Analysis: Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
4. Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5. Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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6. The Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

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Semester III [Second year]										
Branch/Course: Electronics and Communication Engineering										
Sr. No.	Course code	Course Title	L	T	P	Hrs	Internal Marks	External Marks	Total	Credits
1	BTEC- 301-18	Electronic Devices	3	0	0	3	40	60	100	3
2	BTEC- 302-18	Digital System Design	3	0	0	3	40	60	100	3
3	BTEC- 303-18	Electromagnetic Waves	3	1	0	4	40	60	100	4
4	BTEC-304-18	Network Theory	3	1	0	4	40	60	100	4
5	BTAMXXX18	Mathematics III	3	1	0	4	40	60	100	4
6	BTEC-311-18	Electronic Devices Laboratory	0	0	2	2	30	20	50	1
7	BTEC-312-18	Digital System Design Laboratory	0	0	2	2	30	20	50	1
8	HSMC101-18 /HSMC102-18*	Foundational Course in Humanities (Development of Societies or Philosophy)	3	0	0	3	40	60	100	3
9	BTEC-321-18	4-Week Institutional Training	0	0	4	4	40	60	100	Non-credit
10	BMPD-331-18	Mentoring and Professional Development	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
		Total	**18**	**3**	**10**	**31**	**360**	**440**	**800**	**23**

Semester IV [Second year]										
Branch/Course: Electronics and Communication Engineering										
Sr. No.	Course code	Course Title	L	T	P	Hrs	Internal Marks	External Marks	Total Marks	Credits
1	BTEC-401-18	Analog Circuits	3	1	0	4	40	60	100	4
2	BTEC-402-18	Microprocessors and Microcontrollers	3	0	0	3	40	60	100	3
3	BTCS-301-18	Data Structures & Algorithms	3	0	0	3	40	60	100	3
4	BTEC-403-18	Signals and Systems	3	1	0	4	40	60	100	4
5	HSMC122-18	Universal Human Values – 2: Understanding Harmony	3	0	0	3	40	60	100	3
6	EVS-101-18	Mandatory Course-Environmental Sciences	3	0	0	3	100	0	100	Non-credit
7	BTEC-411-18	Analog Circuits Laboratory	0	0	2	2	30	20	50	1
8	BTEC-412-18	Microprocessors and Microcontrollers Laboratory	0	0	2	2	30	20	50	1
9	BMPD-341-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit
		Total	**18**	**2**	**6**	**26**	**360**	**340**	**700**	**19**

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Semester V [Third year]

Branch/Course: Electronics and Communication Engineering

Sr. No.	Course code	Course Title	L	T	P	Hrs.	Internal Marks	External Marks	Total	Credit
1	UC-BTEC-501-18	Analog and Digital Communication	3	1	0	4	40	60	100	4
2	UC-BTEC-502-18	Digital Signal Processing	3	1	0	4	40	60	100	4
3	UC-BTEC-503-18	Linear Integrated Circuits	3	0	0	3	40	60	100	3
4	UC-BTEC-504-18	Control Systems	3	1	0	4	40	60	100	4
5	UC-BTEC-901X-18	Professional Elective-1	3	0	0	3	40	60	100	3
6	BTMS-YYY-18	Project Management	3	0	0	3	40	60	100	3
7	UC-BTEC-511-18	Analog and Digital Communication Laboratory	0	0	2	2	30	20	50	1
8	UC-BTEC-512-18	Digital Signal Processing Laboratory	0	0	2	2	30	20	50	1
9	UC-BTEC-513-18	Linear Integrated Circuits Laboratory	0	0	2	2	30	20	50	1
10	UC-BTEC-521-18	4-Weeks Industrial Training	0	0	6	6	60	40	100	Non-credit
11	BTEC-10X-18	Professional Elective-1 Lab (Optional)	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
12	BMPD-351-18	Mentoring and Professional Development	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
		Total	**18**	**3**	**16**	**37**	**390**	**460**	**850**	**24**

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Semester VI [Third year]										
Branch/Course: B.Tech. Electronics and Communication Engineering										
Sr. No.	Course code	Course Title	L	T	P	Hrs	Internal Marks	External Marks	Total	Credits
1	UC-BTEC-601-18	Wireless Communication	3	0	0	3	40	60	100	3
2	UC-BTCS-602-18	Computer Networks	3	0	0	3	40	60	100	3
3	UC-BTEC-603-18	Optical Fibers & Communication	3	1	0	4	40	60	100	4
4	UC-BTEC-604-18	Microwave and Antenna Engineering	3	1	0	4	40	60	100	4
5	UC-BTEC-906X-18	Professional Elective-2	3	0	0	3	40	60	100	3
6	UC-BTOEC-XXA-18	Open Elective-1	3	0	0	3	40	60	100	3
7	UC-BTEC-611-18	Optical Fibers & Communication Lab	0	0	2	2	30	20	50	1
8	UC-BTEC-612-18	Microwave and Antenna Engineering Laboratory	0	0	2	2	30	20	50	1
9	UC-BTC-631-18	Project-I	0	0	3	3	60	40	100	3
10	UC-BTEC-11X-18	Professional Elective-2 Lab (Optional)	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
11	UC-BMPD-361-18	Mentoring and Professional Development	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
		Total	**18**	**2**	**11**	**31**	**360**	**440**	**800**	**25**

Semester VII/VIII [Fourth year]										
Branch/Course: Electronics and Communication Engineering										
Sr. No.	Course code	Course Title	L	T	P	Hr	Int Marks	Ext Marks	Total	Credits
1	BTEC-907X-18	Professional Elective-3	3	0	0	3	40	60	100	3
2	BTEC-908X-18	Professional Elective-4	3	0	0	3	40	60	100	3
3	BTEC-909X-18	Professional Elective-5	3	0	0	3	40	60	100	3
4	BTEC-YYY-18	Open Elective-2	3	0	0	3	40	60	100	3
5	BTEC-ZZZ-18	Open Elective-3	3	0	0	3	40	60	100	3
6	BTMC-101-18	Indian Constitution-Mandatory Course	3	0	0	3	40	60	100	Non-credit
7	BTMC-102-18	Essence of Indian Traditional Knowledge-Mandatory Course	3	0	0	3	40	60	100	Non-credit
8	BTEC-731-18	Project-II & Report	0	0	12	12	120	80	200	6
9	BTEC-12X-18	Professional Elective 3 or 4 or 5 Lab (Optional)**	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
10	BMPD-371-18	Mentoring and Professional Development	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
		Total	**21**	**0**	**16**	**37**	**400**	**500**	**900**	**21**

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Semester VII/VIII [Fourth year] B.Tech. Electronics and Communication Engineering						
Sr. No.	Course code	Course Title	Internal Marks	External Marks	Total	Credits
1	BTEC- 801-18	Semester Software/Industrial Training & Project	300	200	500	16
		Total	**300**	**200**	**500**	**16**
Total Marks (including B.Tech. 1st Year)			**2680**	**3020**	**5700**	**168**

OR

If the students (minimum 8 students) of any Institute/College do not opt for semester training, then the students shall be required to study the following:

Semester VII/VIII [Fourth year] Branch/Course: Electronics and Communication Engineering										
Sr. No.	Course Code	Course Title	L	T	P	Hr	Int Marks	Ext Marks	Total	Credits
1	BTEC-aaaa-18	Professional Elective	3	0	0	3	40	60	100	3
2	BTEC-bbbb-18	Professional Elective	3	0	0	3	40	60	100	3
3	BTEC-cccc-18	Professional Elective	3	0	0	3	40	60	100	3
4	BTEC-dddd-18	Professional Elective	3	0	0	3	40	60	100	3
5	BTEC-802-18	Simulation and Modelling Lab (Minor Project & Report)	0	0	8	8	60	40	100	4
6	BMPD-381-18	Mentoring and Professional Development	0	0	2	2	Satisfactory/Un-satisfactory			Non-credit
		Total	**12**	**0**	**10**	**22**	**220**	**280**	**500**	**16**

1. Four Professional Elective subjects (each of 3 credits) from any one of the Five Professional Elective Groups (excluding the group which the student has opted earlier).
2. The student will undertake and complete a Minor Project using Simulation and Modelling Lab & submit the Report.
3. Student has to complete 16 credits equivalent to that of One semester Industrial training in this course.

* Student may choose any one of these as foundational courses in HUSS group as given in AICTE Model Curriculum 2018.

** Lab pertaining to the Professional Electives is optional and non-credit, however, it can be offered by the Department to its students as per the lab support available and the discretion of the same lies with the Institution.

Range of credits for Honors Degree -Minimum credits as per scheme are required by a student to be eligible to get Under Graduate degree in Electronics and Communication Engineering.

1. A student will be eligible to get Under Graduate degree with Honours, if he/she completes an additional 20 credits. These could be acquired through MOOCs and registering in the

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department.

2.Range of Credits and Courses for Major Degree in B. Tech. (Electronics and Communication Engineering) and Minor Degree in B.Tech. (Other Engineering)

(i) A student admitted in B. Tech (ECE) may opt for Major Degree in B. Tech. (ECE) and Minor Degree in B.Tech. (other Engineering) with effect from 3rd semester onwards.

(ii) The student must clear his/her previous two semesters.

(iii) The student/candidate will require to clear at least five theory subjects for Minor Degree in B.Tech.

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Subjects for Minor Degree in B.Tech Electronics and Communication Engineering (ECE)

Core Subjects:

S.No.	Subject Code	Course Title	Credits
1.	BTEC-305-18	Basic Electronics	3
2.	BTEC-306-18	Digital Electronics	3
3.	BTEC-401-18	Analog Circuits	4
4.	BTEC-402-18	Microprocessors and Microcontrollers	3
5.	BTEC-403-18	Signals and Systems	4
6.	UC-BTEC-501-18	Analog and Digital Communication	4
7.	UC-BTEC-502-18	Digital Signal processing	4
8.	UC-BTEC-503-18	Linear Integrated Circuits	3
9.	UC-BTEC-504-18	Control Systems	4
10.	UC-BTEC-601-18	Wireless Communication	3
11.	UC-BTEC-603-18	Optical Fibres and Communication	3
12.	UC-BTEC-604-18	Microwave and Antenna Engg.	4

Elective Subjects

S.No.	Subject Code	Course Title	Credits
1.	BTEC- 301-18	Electronic Devices	3
2.	BTEC- 303-18	Electromagnetic Waves	4
3.	UC-BTEC-901C-18	Advance Optical Communication	3
4.	UC-BTEC-902C-18	Mobile Adhoc Networks	3
5.	UC-BTEC-902D-18	Mobile Communication & Networks	3
6.	UC-BTEC-904D-18	Satellite Communication	3
7.	UC-BTEC-902E-18	Artificial Neural Networks	3
8.	BTEC-909A-18	Introduction to Big Data	3
9.	BTEC-908A-18	Artificial Intelligence	3
10.	BTEC-907A-18	Internet of Things (IoT) & Cloud Computing	3
11.	BTEC-907C-18	Robotics and Embedded systems	3
12.	BTEC-908C-18	VLSI Design	3
13.	BTEC-908D-18	Soft Computing	3
14.	BTEC-909D-18	Artificial Intelligence & Machine learning	3
15.	BTEC-907E-18	Adaptive Signal Processing	3
16.	BTEC-908E-18	Digital Image and Video Processing	3

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PROFESSIONAL (or PROGRAM) ELECTIVE (PE) COURSES [ELECTRONICS AND COMMUNICATION ENGINEERING]

The Professional Electives are categorized into three different Groups viz. Electronics Group, Communication Group and Software Group. The Program Elective Groups/courses have been categorized/developed keeping in mind the employment prospects of the students. The Program design in B.Tech. ECE aims at providing domain specific knowledge to a student at UG level in progression. The Program/course design has been carried out jointly by the Academia in close coordination with Industry to provide a leading edge to the students and to prepare them as per the industry needs.

The student is free to choose any one group out of these listed groups. Therefore, the Head and the Faculty of the Department should provide complete guidance and take utmost care to apprise the students in a most diligent manner. Usually, it will not be a case to allow the change of the group, however, in the best interest of the students, a student can be allowed to change the group but the responsibility for teaching the pre requisite courses in the changed group shall rest with the Department/Institute.

Professional Elective Courses (2018 Onward)

Group Name	S. No.	Sem	Elective	Course Code	Course Title	L:T:P	Credits
Electronics Group	1	5	PE-1	UC-BTEC-901A-19	AC & DC Motors	3:0:0	3
	2	6	PE-2	UC-BTEC-902A-19	Power Electronics	3:0:0	3
	3	7	PE-3	BTEC-907A-18	Internet of Things (IoT) & Cloud Computing	3:0:0	3
	4	7	PE-3	BTEC-907C-18	Robotics & Embedded Systems	3:0:0	3
	5	7	PE-4	BTEC-908C-18	VLSI Design	3:0:0	3
	6	7	PE-5	BTEC-909C-18	Embedded Systems Design	3:0:0	3
	7	7	PE-5	BTEC-909E-18	Bio Medical Processing	3:0:0	3
Communication Group	8	5	PE-1	UC-BTEC-901C-19	Satellite Communication	3:0:0	3
	9	6	PE-2	UC-BTEC-902C-19	Mobile Adhoc Networks	3:0:0	3
	10	7	PE-3	BTEC-907B-18	Antenna Radiating Systems	3:0:0	3
	11	7	PE-4	BTEC-908B-18	Mobile Communication and Networks	3:0:0	3
	12	7	PE-4	BTEC-908A-18	Artificial Intelligence	3:0:0	3
	13	7	PE-5	BTEC-909B-18	Information Theory & Coding	3:0:0	3
	14	7	PE-5	BTEC-909D-18	Artificial Intelligence & Machine Learning	3:0:0	3
Software Group	15	5	PE-1	UC-BTEC-901E-19	JAVA Programing	3:0:0	3
	16	6	PE-2	UC-BTEC-902E-19	Artificial Neural Networks	3:0:0	3
	17	7	PE-3	BTEC-907D-18	Python Programming	3:0:0	3
	18	7	PE-3	BTEC-909A-18	Introduction to Big Data	3:0:0	3
	19	7	PE-4	BTEC-908D-18	Soft Computing	3:0:0	3
	20	7	PE-4	BTEC-907E-18	Adaptive Signal processing	3:0:0	3
	21	7	PE-5	BTEC-908E-18	Digital Image & Video Processing	3:0:0	3

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Note: Similar or any other non-repeating relevant courses available on SWAYAM, NPTEL or any other authentic MOOCs platform can be taken by the student with prior approval of Head of the Department. At the end of semester credits earned by the student will be considered for assessment equivalent to three credits in running semester.

LIST OF OPEN ELECTIVE (OE) COURSES OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING FOR STUDENTS OF OTHER PROGRAMS

Sr. No	Course Code	Sem	Course Title	L	T	P	Hours/ Week	Credits
1.	BTEC-301-18	Odd	Electronic Devices	3	0	0	3	3
2.	BTEC-302-18	Odd	Digital System Design	3	0	0	3	3
3.	UC-BTEC-503-18	Odd	Linear Integrated Circuits	3	0	0	3	3
4.	UC-BTEC-504-18	Odd	Control Systems	3	1	0	4	4
5.	BTEC-402-18	Even	Microprocessors and Microcontrollers	3	0	0	3	3
6.	BTEC-403-18	Even	Signals and Systems	3	1	0	4	4
7.	UC-BTEC-502-18	Odd	Digital Signal Processing	3	1	0	4	4
8.	UC-BTEC-601-18	Even	Wireless Communication	3	0	0	3	3
9.	UC-BTEC-902E-18	Odd	Artificial Neural Networks	3	0	0	3	3
10.	UC-BTEC-603-18	Even	Optical Fibers & Communication	3	1	0	4	4
11.	UC-BTEC-604-18	Even	Microwave and Antenna Engineering	3	1	0	4	4
12.	UC-BTEC-902C-18	Even	Mobile Adhoc Networks	3	0	0	3	3
13.	BTEC-907B-18	Odd	Antenna Radiating Systems	3	0	0	3	3
14.	BTEC-907C-18	Odd	Robotics and Embedded systems	3	0	0	3	3
15.	BTEC-908A-18	Odd	Artificial Intelligence	3	0	0	3	3
16.	BTEC-909A-18	Odd	Introduction to Big Data	3	0	0	3	3
17.	BTEC-908B-18	Odd	Mobile Communication and Networks	3	0	0	3	3
18.	BTEC-909B-18	Odd	Information Theory and Coding	3	0	0	3	3
19.	BTEC-908C-18	Odd	VLSI Design	3	0	0	3	3
20	BTEC-909C-18	Odd	Embedded System Design	3	0	0	3	3
21.	BTEC-909D-18	Odd	AI & Machine Learning	3	0	0	3	3
22.	BTEC-908D-18	Odd	Soft Computing	3	0	0	3	3

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MANDATORY COURSES (MC) (Non-Credit Courses)

Sr. No.	MC *	Course Code	Course Title	Hours/Week	Credits
1.	MC-1	BTMC-XXX-18	Environmental Sciences	3L:0T:0P	Nil
2.	MC-2	BTMC-YYY-18	Indian Constitution	3L:0T:0P	Nil
3.	MC-3	BTMC-ZZZ-18	Essence of Indian Traditional Knowledge	3L:0T:0P	Nil

IKGPTU HUSS Courses/Curricular Structure

Semester	L-T-P-C	Course No. & Title
1	2-1-0-3	L-101 Basic English
3	2-1-0-3	HSMC-103/HSMC-104 Foundation Course in Humanities (Development of Societies/Philosophy)
4	2-1-0-3	HSMC122-18 Universal Human Values – 2: Understanding Harmony
5-8	2-1-0-3	Humanities & Social Sciences Management Electives

List of Humanities & Social Sciences Including Management

Sr. No.	Course Code	Course Title	Hours	Credits
1.	HSMC101-18 /HSMC102-18	Foundational Course in Humanities (Development of Societies/Philosophy)	2L:10T:0P	3
2.	HSMC103-18	Education, Technology and Society	2L:10T:0P	3
3.	HSMC104-18	History of Science and Technology in India	2L:10T:0P	3
4.	HSMC105-18	Nyaya Logic Epistemology	2L:10T:0P	3
5.	HSMC106-18	Political and Economic Thought for a Humane Society	2L:10T:0P	3
6.	HSMC107-18	State, Nation Building and Politics in India	2L:10T:0P	3
7.	HSMC108-18	Psychological Process	2L:10T:0P	3
8.	HSMC109-18	Positive Psychology	2L:10T:0P	3
9.	HSMC110-18	Application of Psychology	2L:10T:0P	3
10.	HSMC111-18	Sociology, Society and Culture	2L:10T:0P	3
11.	HSMC112-18	Epochal Shift	2L:10T:0P	3
12.	HSMC113-18	Values and Ethics	2L:10T:0P	3
13.	HSMC114-18	Ethics and Holistic Life	2L:10T:0P	3
14.	HSMC115-18	Folk and Vernacular Expressive Tradition and Popular Culture	2L:10T:0P	3

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15.	HSMC116-18	Universal Human Conduct	2L:10T:0P	3
16.	HSMC117-18	Gender Culture and Development	2L:10T:0P	3
17.	HSMC118-18	Introduction to Women's and Gender Studies	2L:10T:0P	3
18.	HSMC118-18	Introduction to Women's and Gender Studies	2L:10T:0P	3
19.	HSMC119-18	Advance Course in Peace Research	2L:10T:0P	3
20.	HSMC120-18	Contemporary India in Globalized Era: Challenges of Democracy and Development	2L:10T:0P	3
21.	HSMC121-18	Making Indian Culture: Epistemic Traditions, Literature and Per formative Arts	2L:10T:0P	3
22.	HSMC122-18	Universal Human Values 2: Understanding Harmony	2L:10T:0P	3
23.	HSMC123-18	Human relations at work	2L:10T:0P	3
24.	HSMC124-18	Sanskrit Bhasa	2L:10T:0P	3
25.	HSMC125-18	Language and Communication	2L:10T:0P	3
26.	HSMC126-18	Language and Linguistics	2L:10T:0P	3
27.	HSMC127-18	Understanding Society and Culture through Literature	2L:10T:0P	3
28.	HSMC128-18	Fundamentals of Linguistics	2L:10T:0P	3
29.	HSMC128-18	Fundamentals of Linguistics	2L:10T:0P	3
30.	HSMC129-18	Elements of Literature	2L:10T:0P	3
31.	HSMC130-18	Humanities and Multiple Dimensions of Ecology	2L:10T:0P	3
32.	HSMC131-18	Film Appreciation	2L:10T:0P	3
33.	HSMC(MIM-472)	Introduction to Industrial Management	2L:10T:0P	3
34.	HSMC (MIM-480)	Macro Economics	2L:10T:0P	3
35.	HSMC (MIM-578)	Quantitative Methods for Decision Making	2L:10T:0P	3
36.	HSMC (MIM-475)	Economics for Engineers	2L:10T:0P	3
37.	HSMC (MME-301)	Fundamentals of Management for Engineers	2L:10T:0P	3
38.	HSMC (MME-302)	Project Management and Entrepreneurship	2L:10T:0P	3
39.	HSMC (MME-303)	Law and Engineering	2L:10T:0P	3
40.	HSMC (MME-304)	Understanding Interpersonal Dynamics	2L:10T:0P	3

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THIRD SEMESTER

B. Tech.

Electronics & Communication Engineering

Syllabus

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BTEC-301-18	Credits	L	T	P	Int	Ext
Electronic Devices	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to recall concepts of semiconductor physics and understand the behaviour and working of semiconductor devices using mathematical models.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand physics of semiconductors and behavior of charge carriers within semiconductors
2. Understand the working of semiconductor diodes supported with mathematical explanation.
3. Understand the working of BJT and MOSFET with their equivalent small signal models.
4. Understand the chemical processes used in fabrication of integrated circuits.

Unit 1: Semiconductor Physics

Review of quantum mechanics; electrons in periodic lattices; e-k diagrams; energy bands in intrinsic and extrinsic silicon; diffusion current; drift current; mobility and resistivity; sheet resistance; design of resistors.

Unit 2: Diodes

Generation and recombination of carriers; Poisson and continuity equation p-n junction characteristics; V-I characteristics; small signal switching models; avalanche breakdown; Zener diode; Schottky diode; light emitting diode; tunnel diode; varactor diode, solar cell, Rectifier & Regulator circuits.

Unit 3: Transistors

Bipolar junction transistor; V-I characteristics; Ebers-Moll model; Transistor Configurations - CE, CB, CC; MOS capacitor; MOSFET - Construction and Working; I-V characteristics; Depletion-type and Enhancement-type MOS.

Unit 4: Fabrication Processes

Oxidation; diffusion; ion-implantation; Annealing; photolithography; etching; chemical vapour deposition (CVD); sputtering; twin-tub CMOS process.

Recommended Books

1. G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, Pearson.
2. D. Neamen, D. Biswas, Semiconductor Physics and Devices, McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, Physics of Semiconductor Devices, John Wiley & Sons
4. C. T. Sah, Fundamentals of solid state electronics, World Scientific Publishing Co. Inc.

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BTEC-302-18	Credits	L	T	P	Int	Ext
Digital System Design	3	3	0	0	40	60

Course Objective

This is course deals with fundamental concepts of digital electronics necessary many other courses, like embedded systems, VLSI and computer architecture, etc. to be studied in coming semesters.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Apply concepts of Boolean algebra for handling logical expressions.
2. Understand working and realization of combinational circuits.
3. Understand working flip-flops and use them in designing of sequential circuits.
4. Understand fundamental concepts of logic families and architectural of programmable devices.
5. Use HDL programming tool for simulation of combinational & sequential circuits.

Unit 1: Boolean Algebra & Combinational Circuits

Logic gates; Boolean algebra; De Morgan's theorem, SOP & POS forms, canonical forms, Karnaugh maps up to 6 variables, binary codes, code Conversion, MSI devices like comparators; multiplexers; encoder; decoder; driver & multiplexed display; half and full adders; subtractors; serial and parallel adders; BCD adder; barrel shifter and ALU.

Unit 2: Sequential Circuits

Building blocks of sequential circuits like S-R, J-K,T & D flip-flops; master-slave J-K FF; edge triggered FF; ripple counters; synchronous counters; shift registers; finite state machines; design of synchronous FSM, algorithmic state machines charts; designing synchronous circuits like pulse train generator; pseudo random binary sequence generator; clock generation.

Unit 3: Programmable Devices & ADC and DAC

Specifications: noise margin, propagation delay, fan-in, fan-out, Tristate; TTL, ECL, CMOS families and their interfacing; architectures of PLA, PAL, GAL, CPLD&FPGA. DAC: weighted resistor, R-2R ladder, resistor string; ADC: single slope, dual slope, successive approximation, flash.

Unit 4: Introduction to VHDL

VHDL constructs; Data types and objects; different modelling styles in VHDL; Dataflow, Behavioural and Structural Modelling; Synthesis and Simulation; HDL programming for basic combinational and sequential circuits.

Recommended Books

1. R.P. Jain, Modern digital Electronics, Tata McGraw Hill
2. Douglas Perry, VHDL, Tata McGraw Hill
3. W.H. Gothmann, Digital Electronics-An introduction to theory and practice, PHI
4. D.V. Hall, Digital Circuits and Systems, Tata McGraw Hill
5. Charles Roth, Digital System Design using VHDL, Tata McGraw Hill

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BTEC-303-18	Credits	L	T	P	Int	Ext
Electromagnetic Waves	4	3	1	0	40	60

Course Objective

This course deals with knowledge and background required for better understanding of Electromagnetic Waves and fundamentals.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand characteristics & wave propagation through transmission lines
2. Understand Maxwell's equations for electromagnetic waves
3. Characterize uniform plane wave
4. Calculate reflection and transmission of waves at media interface

Unit 1: Transmission Lines

Equations of voltage and current on transmission line; propagation constant and characteristic impedance, and reflection coefficient and VSWR; Loss-less and Low-loss transmission line; Power transfer on transmission line; S-parameters, Smith chart; applications of transmission lines; impedance matching; use of transmission line sections as circuit elements.

Unit 2: Maxwell's Equations

Basics of vectors; Vector calculus; Basic laws of Electromagnetic; Maxwell's equations; Boundary conditions at media Interface.

Unit 3: Uniform Plane Wave

Uniform plane wave; propagation of wave; wave polarization; Poincare's sphere; wave propagation in conducting medium; phase and group velocity; power flow and Poynting vector; surface current and power loss in a conductor.

Unit 4: Plane Waves at a Media Interface

Plane wave in arbitrary direction; reflection and refraction at dielectric interface; total internal reflection; wave polarization at media interface; reflection from a conducting boundary.

Unit 5: Wave propagation in parallel plane waveguide

Analysis of waveguide general approach; rectangular waveguide, modal propagation in rectangular waveguide; surface currents on the waveguide walls, field visualization, attenuation in waveguide.

Recommended Books

1. RK Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India
2. EC Jordan & KG Balmain, Electromagnetic waves & Radiating Systems, PHI
3. N Rao, Engineering Electromagnetics, Prentice Hall
4. D Cheng, Electromagnetics, Prentice Hall
5. W H Hayt & J A Buck, Engineering Electromagnetics, McGraw Hill

BTEC-304-18	Credits	L	T	P	Int	Ext
Network Theory	4	3	1	0	40	60

Course Objective

This course is meant to create mathematical foundation which can further be extrapolated to understand and analyze the electrical networks.

Course Outcomes

At the end of this course student will be able to:

1. Analyze linear networks using network theorems.
2. Use Laplace transform to analyze transient & steady state response of linear networks.
3. Comprehend network parameters to analyze two port networks.
4. Realize one port networks using Foster's and Cauer's methods.

Unit 1: Network Theorems

Node and mesh analysis; impedance matrix approach for networks analysis; Network theorems: superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC circuits; Trigonometric and Exponential Fourier series, Fourier Transform and continuous spectra Three phase unbalanced circuit and power calculation.

Unit 2: Transient & Steady State Analysis

Transient behavior, concept of complex frequency, Driving points, Poles and Zeros, Laplace transforms and properties: singularity functions, waveform synthesis; time domain analysis of RC, RL & RLC networks with and without initial conditions; Laplace Transforms for steady state and transient response of networks, quality factor.

Unit 3: Two Port Networks

Impedance parameters; admittance parameters; transmission parameters; hybrid parameters; inter-relationships between two port network parameters; interconnection of two port networks; T and Pi representation of two port networks; image impedance; characteristic impedance; propagation constant; filters: low pass, high pass; band pass, band stop & Butterworth filter.

Unit 4: Network Synthesis

Realizability criteria: Hurwitz polynomial, positive real functions; network realization using Foster's first and second forms; network synthesis using Cauer's first and second forms.

Recommended Books

1. Van, Valkenburg, Network Analysis, PHI
2. F F Kuo, Network Analysis & Synthesis, Wiley
3. A. Sudhakar, S P Shyammohan, Circuits and Network, Tata McGraw-Hill
4. A William Hayt, Engineering Circuit Analysis, McGraw-Hill Education

BTAM-303-18	Credits	L	T	P	Int	Ext
Mathematics III	4	3	1	0	40	60

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables along with Probability and Correlation. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
5. To provide an overview of probability and statistics to engineers

Unit 1: Transforms Calculus-I

Laplace Transform, Properties of Laplace Transform, Laplace Transform of Unit step function, Impulse function, Dirac-delta function, Periodic functions. Inverse Laplace Transform, convolution theorem, Evaluation of integrals by Laplace Transform, Applications to ODEs and PDEs.

Unit 2: Transforms Calculus-II

Fourier Series, half range Fourier Sine and Cosine series, Fourier integrals, Gibbs Phenomenon, Fourier transforms, Relation between Laplace and Fourier transform, Properties of Fourier Transforms, Convolution Theorem and applications

Unit 3: Transforms Calculus-III

Basic theory of Z transforms, Translation theorem, Scaling property of Z transforms, Initial and Final value theorems, Differentiation of Z tranforms Solution of Difference equations using Z transform, Applications of Z transforms to find the sum of series

Unit 4: Probability

Conditional probability, Discrete and continuous random variables, Probability distributions: Binomial, Poisson and Normal, Poisson approximation to the binomial distribution, evaluation of statistical parameters for these three distributions.

Unit 5: Correlation and regression

Correlation and Regression for bivariate data, Rank correlation, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance for small and large samples (z-test, t-test, F-test and Chi-square test).

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Recommended Books

1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
2. R K jain and Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing, 2017.
3. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
4. S. Ross, "A First Course in Probability", Pearson Education India, 2002.
5. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.

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BTEC-311-18	Credits	L	T	P	Int	Ext
Electronic Devices Lab	1	0	0	2	30	20

Course Objective

This is basic course meant to give hands on experience of semiconductor devices and making them to use in circuits & projects.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Realize use of diodes in circuits with proper understanding to their working.
2. Understand characteristics & working of BJT in different configurations.
3. Understand characteristics & working of MOSFET in circuits.
4. Think and design working circuits based on diodes, BJTs and MOSFETs.

Part-A: Experiments

List of Experiments

1. To Study of datasheets of semiconductor devices.
2. To study the V-I characteristics of PN junction Zener diode.
3. To study a Zener diode as voltage regulator.
4. To study the output waveform of a Half-wave rectifier.
5. To study the output waveform of a Full-wave center-tapped and bridge rectifier.
6. To study Input & output V-I characteristics of npn/pnp BJT in CE configuration
7. To study Input & output V-I characteristics of npn/pnp BJT in CB configuration
8. To study Input & output V-I characteristics of npn/pnp BJT in CC configuration
9. To study the functioning of a BJT as a switch.
10. To study V-I Characteristics of a MOSFET.

Part-B: Lab Projects

Every individual student is required design and build one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1. Blinking linear/circular lights
2. Ambient light sensor based controller
3. Regulated dual power supply of ±5V or ±12V or mixed
4. BJT audio amplifier
5. BJT circuit for sampling of analog signal
6. Simulate any project idea using SPICE software

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BTEC-312-18	Credits	L	T	P	Int	Ext
Digital System Design Lab	1	0	0	2	30	20

Course Objective

This is laboratory course meant to realize basic digital circuits using physical components and EDA tools in simulation environment.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Realize combinational circuits using logic gates.
2. Realize sequential circuits using logic gates.
3. Write & simulate VHDL programs for combinational & sequential circuits.
4. Think and design working projects using digital 74XX ICs.

Part-A: Experiments (Any 10 Experiments)

1. To verify the Truth-tables of all logic gates.
2. To realize and verify the Half & full adder circuits using logic gates.
3. To realize Half & full subtractor circuits using logic gates.
4. To realize 4-bit binary-gray & gray-binary converters.
5. To realize comparator circuit for two binary numbers of 2-bit each.
6. To realize Full adder & full subtractor circuits using 8x3 encoder.
7. To design Full adder & full subtractor circuits using 8x3 demultiplexer.
8. To design and verify the Truth tables of all flip-flops.
9. To design Mod-6/Mod-9 synchronous up-down counter.
10. To write VHDL program for combinational & sequential circuits from S. No. 2 to 7
11. To write VHDL program for universal shift-register operations

Part-B: Lab Projects

Every individual student is required design one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1. Pulse Width Modulator based LED dimmer using 555 timer IC.
2. Up-down 4-bit counter with seven-segment display.
3. Construction of combinational circuits using universal gates.
4. Bi-directional visitors counter
5. Traffic light control system
6. Any project based on Arduino platform

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HSMC 101-18/HSMC 102-18	Credits	L	T	P	Int	Ext
Foundational Course in Humanities (Development of Societies or Philosophy)	3	3	0	0	40	60

The syllabus is same as in HUSS subjects given by AICTE Model Curriculum

BTEC-321-18	Credits	L	T	P	Int	Ext
4-Week Institutional Training	Non-credit	0	0	4	60	40

Four weeks training in the area of Electronics and Communication Engineering. This training should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her.

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BMPD-331-18	Credits	L	T	P	Int	Ext
Mentoring and Professional Development*	Non-credit	0	0	2	S/US**	

* As stated in the IKGPTU B.Tech 1st Year Scheme and Syllabus
**S/US - Satisfactory and Unsatisfactory
* Guidelines regarding Mentoring and Professional Development
The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record of students for each activity conducted and the same shall be submitted to the department.

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FOURTH SEMESTER

B. Tech.

Electronics & Communication Engineering

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BTEC-401-18	Credits	L	T	P	Int	Ext
Analog Circuits	4	3	1	0	40	60

Course Objective

This course deals design & analytical concepts of various Analog circuits like BJT/FET circuits, feedback amplifiers, oscillators, power amplifiers.

Course Outcomes

At the end of this course student will be able to:

1. Understand the biasing of transistors and analyze BJT/FET amplifiers
2. Analyze various rectifier and amplifier circuits
3. Analyze sinusoidal and non-sinusoidal oscillators
4. Understand various types of Power Amplifiers

Unit 1: Diode and Transistor Amplifier Circuits

Diode Circuits, Amplifiers types: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier; biasing schemes for BJT and FET amplifiers; bias stability; transistor configurations: CE/CS, CB/CG, CC/CD and their features; small-signal analysis; low-frequency transistor models; amplifier analysis: current gain, voltage gain, input resistance and output resistance; amplifier design procedure; low frequency analysis of multistage amplifiers. High frequency transistor models.

Unit 2: Feedback Amplifiers

Feedback topologies: Voltage series, current series, voltage shunt and current shunt feedback; effect of feedback on gain, bandwidth, input & output impedances; concept of stability, gain margin and phase margin.

Unit 3: Oscillators Introduction, Types of Oscillators, Barkhausen criterion, RC-phase shift, Wien bridge, Hartley, Colpitt, Clapp oscillators and non-sinusoidal oscillators.

Unit 4: Power Amplifiers

Class A, B, AB and C power amplifiers, their efficiency and distortions; frequency response: single stage, multistage amplifiers and cascade amplifier

Recommended Books

1. J Millman & A Grabel, Microelectronics, McGraw Hill
2. J Millman & C Halkias, Integrated Electronics, Tata McGraw Hill
3. A Ramakant, Gayakwad, Op-Amps And Linear Integrated Circuits, PHI
4. P Horowitz & W Hill, The Art of Electronics, Cambridge University Press
5. A S Sedra & K C Smith, Microelectronic Circuits, Saunder's College Publishing

BTEC-402-18	Credits	L	T	P	Int	Ext
Microprocessors and Microcontrollers	3	3	0	0	40	60

Course Objective

This is course deals with fundamental concepts of digital electronics necessary many other courses, like embedded systems, VLSI and computer architecture, etc. to be studied in coming semesters.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand architecture &functionalities of different building block of 8085 microprocessor.
2. Understand working of different building blocks of 8051 microcontroller.
3. Comprehend and apply programming aspects of 8051 microcontroller.
4. Interface & interact with different peripherals and devices.

Unit 1: Microprocessor 8085

History of microprocessors; microprocessor 8085 Architecture, Pin configuration; Memory Interfacing; microprocessor programming model; 8085 instructions; Addressing modes; programming techniques, counters and time delays; stack and subroutines; interrupts.

Unit 2: Microcontroller 8051 - Building Blocks

Microprocessor vs microcontroller; RISC vs CISC architectures; microcontroller 8051: architecture, pin configuration, flag-bits and PSW register, input-output ports, register banks and stack; semiconductor memories: ROM, SRAM, DRAM, virtual memory, cache memory; memory organization.

Unit 3: Microcontroller 8051 - Programming

Assembly language programming; data types and directives; jump loop and call instructions; I/O port programming; addressing modes and accessing memory using various addressing modes; arithmetic instructions and programs; logic instructions and programs; single bit instructions and programming, 8051 interrupts; timer/counter programming in the 8051.

Unit 4: Microcontroller 8051 - Interfacing

Parallel and serial ADC& DAC interfacing; LCD interfacing, Keyboard interfacing; sensor interfacing; interfacing with external memory; matrix keypad; stepper motor interfacing; DC motor interfacing and PWM.

Recommended Books

1. R S Gaonkar, Microprocessor Architecture, Programming and Application with 8085, Penram International Publishing Pvt. Ltd.
2. Kenneth Ayala, The 8051 Microcontroller, Cengage Learning
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill

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4. Subrata Ghoshal, 8051 Microcontroller: Internals, Instructions, Programming and Interfacing, Pearson Education
5. K Uma Rao, Andhe Pallavi, The 8051 Microcontrollers: Architecture, Programming and Applications, Pearson Education.

BTCS-301-18	Credits	L	T	P	Int	Ext
Data Structures and Algorithms	3	3	0	0	40	60

Finalized by the concerned Board of Studies of Department of Computer Science and Engineering.

Course Objectives:

The objective of the course is to impart the basic concepts of data structures and algorithms, to understand concepts about searching and sorting technique and to understand basic concepts about stacks, queues, lists, trees and graphs, data structures.

Course outcomes

Student will be able to:

1. Understand operations like searching, insertion, deletion, traversing on linear Data Structures and to determine their computational complexities
2. Understand operations like searching, insertion, deletion, traversing on various nonlinear Data Structures and to determine their computational complexities
3. Write algorithms for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
4. Apply appropriate Data Structure as per specific problem definition

Detailed contents: Module 1:

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

Introduction to pointers and dynamic memory allocation, use of pointers in self-referential data structures.

Module 2:

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3:

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack

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and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis, Applications of Binary Trees.

Module 4:

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Suggested books:

1. "Classic Data Stuructures", Samanta and Debasis, PHI publishers
2. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
3. "Data Structures with C (Schaum's Outline Series)",Seymour Lipschutz, Mc Graw Hill.
4. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
5. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.

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BTEC-403-18	Credits	L	T	P	Int	Ext
Signals & Systems	4	3	1	0	40	60

Course Objective: The objective of this course is to enable students to apply mathematical concepts and tool in analysis of electrical signals and systems.

Course outcomes:

At the end of this course students will demonstrate the ability to:

1. Mathematically characterize different types of signals and systems.
2. Analyze the behavior of linear-shift invariant systems.
3. Apply concepts of Fourier and Laplace Transforms to analyze continuous-time signals and systems.
4. Investigate discrete-time signals and systems using Discrete-Time Fourier and Z-Transforms and simple Probability concepts.

Unit 1: Introduction to Signals and Systems

Classification of Signals: Periodic and Aperiodic signals, continuous and discrete time signals, continuous and discrete amplitude signals; Linear and nonlinear signals, Causal and non-causal signals, Even and odd signals, Energy and power signals; System properties: linearity, shift-invariance, causality, stability, Realizability.

Unit 2: Linear-Shift Invariant Systems

Linear shift-invariant systems; Impulse response and step response ;Convolution, Input-output behaviour with Aperiodic convergent inputs; Characterization of causality and stability of LSI systems; System representation through differential equations and difference equations; Periodic inputs to an LSI system; Notion of frequency response and its relation to the impulse response.

Unit 3: Continuous-Time Analysis of Signals and Systems

Fourier Series; Fourier Transform; Magnitude and phase response; Properties of Fourier Transform: Convolution/Multiplication, Duality, Time-shifting, Frequency-shifting, Time-scaling, Integration and differentiation in time-domain; Review of Laplace Transform for continuous-time signals and systems; Notion of Eigen functions of LSI systems; System transfer function and poles-zeros analysis; Solution to differential equations and system behaviour.

Unit 4: Discrete-Time Analysis of Signals and Systems

Sampling Theorem and its proof; Spectra of sampled signals; Aliasing and its effects; Reconstruction and its implications; Probability: Mean, median, mode and standard deviation; combinatorial probability, probability distribution functions. Discrete-Time Fourier Transform (DTFT); Discrete Fourier Transform; Parseval's Theorem; Review of Z-Transform for discrete-time signals and systems; System functions; Region of convergence and z-domain analysis, Conditional Probability.

Recommended Books:

1. Allan V. Oppenheim, S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education
2. I J Nagrath, S N Sharan, R Ranjan S Kumar, Signals and Systems, Tata McGraw Hill
3. B.P. Lathi, Signal Processing and Linear Systems, Oxford University Press
4. S Poornachandra, B Sasikala, Signals and Systems, Tata McGraw Hill
5. Robert A. Gabel, Richard A. Roberts, Signals and Linear Systems, John Wiley and Sons.

HSMC 122-18	Credits	L	T	P	Int	Ext
Universal Human Values-2 : Understanding Harmony	3	3	0	0	40	60

The syllabus of this course is same as given in detailed HUSS group syllabus in AICTE Model Curriculum 2018.

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EVS-101-18	Credits	L	T	P	Int	Total
Mandatory Course: Environmental Sciences	Non-credit	3	0	0	100	100

Finalized by the Board of Studies of Department of Civil Engineering.

Course Outcomes:

1. Students will enable to understand environmental problems at local and national level through literature and general awareness.
2. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.
3. The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.
4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world

1. Environment Science (Mandatory non-credit course)

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students.

Detailed Contents

Module 1: Natural Resources: Renewable and non-renewable resources

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resoureces for sustainable lifestyles.

Module 2: Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems:

a. Forest ecosystem
b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3: Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biodiversity at global, National and local levels.
- Inida as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India

Module 4: Social Issues and the Environment

- From Unsustainable to Sustainable development
- Resettlement and rehabilitation of people; its problems and concerns.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust. Case Studies.
- Public awareness.

*ACTIVITIES

Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity)

Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.

Following activities must be included.

Identify a tree fruit flower peculiar to a place or having origin from the place.

Making high resolution big photographs of small creatures (bees, spiders, ants. mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).

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Videography/ photography/ information collections on specialties/unique features of different types of common creatures.

Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems

1*(A) Awareness Activities:*

a) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
b) Slogan making event
c) Poster making event
d) Cycle rally
e) Lectures from experts
f) Plantation
g) Gifting a tree to see its full growth
h) Cleanliness drive
i) Drive for segregation of waste
i) To live with some eminent environmentalist for a week or so to understand his work
j) To work in kitchen garden for mess
k) To know about the different varieties of plants
l) Shutting down the fans and ACs of the campus for an hour or so
m) Visit to a local area to document environmental assets river/forest/grassland/hill/mountain/lake/Estuary/Wetlands
n) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
o) Visit to a Wildlife sanctuary, National Park or Biosphere Reserve

Suggested Readings

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
7. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
8. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
9. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
12. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)
13. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
14. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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BTEC-411-18	Credits	L	T	P	Int	Ext
Analog Circuits Lab	1	0	0	2	30	20

Course Objective

This laboratory course deals design & analytical concepts of various analog circuits like BJT/FET circuits, feedback amplifiers, oscillators, power amplifiers.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Study and verify the characteristics of diodes/BJTs in circuits with proper understanding to their working.
2. Understand frequency response & working of various types of Oscillators.
3. Understand characteristics & working of Power amplifiers.
4. Think and design working circuits based on diodes, BJTs and MOSFETs.

Part-A: Experiments

List of Experiments:

1.To study the Input/Output V-I characteristics of BJT in CE configuration.
2.To study Emitter follower circuit.
3. To calculate the frequency of RC phase shift oscillator.
4.To study the frequency response of Wein bridge oscillator.
5. To study the frequency response of Hartley oscillator.
6. To study the frequency response of Colpitt's oscillator.
7. To study Gain analysis of Class-A Power Amplifier
8. To study Gain analysis of Class-B Power Amplifier
9. To study Gsain analysis of Class B Push-pull Power Amplifier
10. To study Gain analysis of Class-C Power Amplifier

Part-B: Lab Projects

Every individual student is required design one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1. BJT audio amplifier
2. Op-Amp based square and triangular waveform generator
3. Any project based on IoT/Arduino platform

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BTEC-412-18	Credits	L	T	P	Int	Ext
Microprocessors and Microcontrollers Lab	1	0	0	2	30	20

Course Objective

This is laboratory course meant to write programs using 8085/8086 microprocessor and learn interfacing using 8051 microcontoller for general operations.

Course Outcomes

At the end of this Lab course student will be able to:

1. Write programs for common arithmetic operations with 8-bit/16-bit numbers using 8085.
2. Write programs for transfer, sort block of data with 8085 processor.
3. Write programs for controlling stepper and DC motors using Microprocessor(s).
4. Write programs to generate waveforms and interface ADC and DAC using of 8051 Microcontroller.

Part-A: Write programs in Assembly language & embedded C to

1. Add two 8-bit numbers stored in registers or internal/External memory locations.
2. Multiply two 8-bit numbers.
3. Multiply two 16-bit numbers.
4. Transfer block of data from internal memory locations to external memory locations
5. Sort block of data in ascending or descending order.
6. Generate 5KHz pulse waveform of 50% duty cycle.
7. Interface ADC and DAC.
8. Interface Matrix Keyboard.
9. Interface LCD Displays.
10. Interface Stepper Motor.
11. Control DC motor using PWM.

Part-B: Lab Projects

Every individual student is required design one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1. RFID attendance system
2. Home automation
3. Robotic vehicle
4. Sensor traffic lights
5. Floor cleaning robot
6. Robot for defense applications
7. GPS vehicle tracking
8. Accident identification and SMS

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BMPD-341-18	Credits	L	T	P	Int	Ext
Mentoring and Professional Development*	Non-credit	0	0	2	S/US**	

* As stated in the IKGPTU B.Tech 1st Year Scheme and Syllabus
**S/US - Satisfactory and Unsatisfactory

* Guidelines regarding Mentoring and Professional Development
The objective of mentoring will be development of:
- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

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FIFTH SEMESTER

B. Tech.

Electronics & Communication Engineering

Syllabus

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UC-BTEC-501-18	Credits	L	T	P	Int	Ext
Analog and Digital Communication	4	3	1	0	40	60

Course Objective

This is one of the fundamental courses meant to know the concepts of Analog as well as Digital Communication and understand the working of common communication techniques.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise
3. Investigate pulsed modulation system and analyze their system performance
4. Analyze different digital modulation schemes and can compute the bit error performance

Unit 1: Analog Communication

Review of Signals and Systems, Frequency domain representation of signals, Amplitude Modulation: Transmission and Reception of DSB, SSB and VSB, Angle Modulation, Spectral characteristics of angle modulated signals, Principles of Frequency and Pulse Modulation, Representation of FM and PM signals

Unit 2: Elements of Detection Theory

Review of white noise characteristics, Noise in amplitude modulation and Angle Modulation systems, Pre-emphasis and De-emphasis. Review of probability and random process Gaussian noise characteristics, Baseband Pulse Transmission: Inter symbol Interference and Nyquist criterion.

Unit 3: Digital Communication

Analog to Digital: Need, Sampling process, Pulse Amplitude modulation and Concept of Time division multiplexing, Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation and demodulation, Adaptive and Sigma Delta Modulation, Noise considerations in PCM, Digital Multiplexers.

Unit 4: Digital Modulation Techniques

Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

Recommended Books

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering", John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

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UC-BTEC-502-18	Credits	L	T	P	Int	Ext
Digital Signal Processing	4	3	1	0	40	60

Course Objective

This is one of the fundamental courses meant to know the concepts of Digital Signal Processing and understand the commonly used digital filters and systems.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications

Unit 1: Discrete Time Signals & Systems

Review of Signals & System, Discrete time sequences and systems; Representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Basic elements of digital signal processing such as convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations. Implementation of Discrete Time Systems, Linear Periodic and Circular convolution, Z-Transform, Inverse Z-Transform methods, Properties of Z-Transform.

Unit 2: Analysis of Discrete LTI sytesms

Analysis of Linear time invariant systems, Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) with their properties, Inverse DFT and FFT methods, Goertzel Algorithm.

Unit 3: Digital filters Design

Structures of realization of discrete time system, direct form, Cascade form, parallel form and lattice structure of FIR and IIR systems. Time Invariant and Bilinear Transformation Methods, Rectangular, Hamming and Hanning Window methods, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low pass, Band pass, Band stop and High pass filters. Effect of finite register length in FIR filter design, Matched Z-Transformation, Analog and Digital Transformation in the Frequency Domain.

Unit 4: Introduction to Multirate signal processing and DSP processors

Concepts of Multirate Signal Processing, need and significance, Applications of DSP, Limitations of Analog signal processing, Advantages of Digital signal processing, Introduction to Architectures of ADSP and TMS (C6XXX) series of processors.

Recommended Books

1. S. K. Mitra, Digital Signal Processing: A computer based approach. TMH, 2001.
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

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UC-BTEC-503-18	Credits	L	T	P	Int	Ext
Linear Integrated Circuits	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to introduce the theoretical & circuit aspects of Op-amp, which is the backbone for the basics of Linear integrated circuits.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. **Infer** AC & DC analysis of constituent blocks of Op-Amp.
2. **Interpret** and **elaborate** the characteristics and parameters of Op-Amp circuits.
3. **Analyze** and **design** linear and non-linear applications using op-Amp circuits.
4. **Explain** working and applications of Timer, PLL and Voltage regulators ICs.

Unit I: Differential Amplifiers

Differential amplifier circuit configurations: Dual input-balanced output, Dual input-unbalanced output, Single input-balanced output and Single input-unbalanced output differential amplifier; DC analysis of differential amplifier; AC analysis of differential amplifier differential; Differential amplifier with swamping resistors; Constant current bias and current mirror circuits; Level translator circuit; Differential amplifier using Op-Amp;

Unit II: Operational Amplifiers

Op-Amp IC741: Block diagram representation, Schematic representation, IC packaging types, Pin Identification, Operational temperature ranges, Overview & interpretation of IC datasheets; Characteristics of ideal and practical Op-Amp; Equivalent circuit of an Op-Amp and its voltage transfer curve; Op-Amp parameters: Input offset voltage, Input bias current, Input offset current, Output offset voltage, Thermal drift, Common Mode Rejection Ratio (CMRR), Power Supply Rejection Ratio (PSRR), Slew rate; Effects of positive and negative feedbacks on Op-Amp circuits.

Unit III: Applications of Op-Amp

DC and AC amplifiers: Differential, Inverting & Non-Inverting amplifiers; Peaking Amplifier; Summing, Scaling, Averaging Amplifiers & D/A Converter; Voltage to current converter; Current to voltage converter; Log and Antilog amplifier; Integrator circuit; Differentiator circuit; Comparator circuit; Window detector; Zero-crossing detector; Schmitt trigger; Butterworth filters: First order low pass and high pass filters, Second order low pass and high pass filters, Higher order filters, Band pass filter, Band reject filters and all pass filter; Oscillators & waveform generators: Phase shift oscillator, Wein bridge oscillator, Quadrature oscillator, Square wave generator, Triangular wave generator, Sawtooth wave generator, Voltage controlled oscillator; V to F and F to V converters; Instrumentation Amplifier.

Unit IV: Specialized IC Applications

IC 555 Timer: Pin configuration, Block diagram; Application of IC 555: Monostable, Astable and Bistable multivibrator; Phase Lock Loops: Operating principles & applications of IC 565; Voltage Regulators: Fixed voltage regulators, Adjustable voltage regulators, Switching regulators.

Recommended Books

1. Op Amps & Linear Integrated Circuits by Ramakant A. Gayakwad, Pearson, 4th Ed.
2. Design with Operational Amplifiers and Analog Integrated Circuits, Sergio Franco, TMH
3. Operational Amplifiers and Linear Integrated Circuits by R.F. Coughlin & F.F. Driscoll, PHI, 1996

UC-BTEC-504-18	Credits	L	T	P	Int	Ext
Control Systems	4	3	1	0	40	60

Course Objective

This is the course meant to gain the knowledge of important control systems, characterize them and study their state behaviour.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Characterize a system and find its study state behaviour
2. Investigate stability of a system using different tests
3. Design various controllers
4. Solve liner, non-liner and optimal control problems

Unit 1: Introduction to Control Systems

Industrial Control system examples. Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, DC and AC servomotors, Tacho generators, Electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Open loop and Closed-loop systems. Block diagram and signal flow graph analysis.

Unit 2: Feedback Control systems

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feed forward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion. Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design.

Unit 3: Frequency Response Analysis

Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. State variable formulation and solution.

Unit 4: State variable Analysis

Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

Recommended Books:

1. Manke,B.S "Linear Control Systems" Khanna Publishers, Twelfth Edition,2005
2. Gopal. M., "Control Systems: Principles and Design", Tata Mc Graw-Hill, 1997.
3. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
4. Ogata, K., "Modern Control Engineering" , Prentice Hall, second edition, 1991.
5. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi.

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BTMS-YYY18 Project Management	Credits	L	T	P	Int	Ext
	3	3	0	0	40	60

Course Objective: To acquaint the students with the steps involved in the planning, implementation, scheduling and control of projects.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Study the basic concepts of Project Management.
2. Learn about Project selection and organisation.
3. Understand Project planning and scheduling.
4. Learn about Project Monitoring, control and performance.

UNIT-I: Project Management Concepts Attributes of a Project, Project Life Cycle, The Project management Process, Global Project Management, Benefits of Project Management, Needs Identification.

UNIT-II: Project Selection, Preparing a Request for Proposal, Soliciting Proposals, Project organization, the project as part of the functional organization, pure project organization, the matrix organization, mixed organizational systems.

UNIT-III: Project Planning and Scheduling: Design of project management system; project work system; work breakdown structure, project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT / CPM)/ GERT, Resource allocation, Crashing and Resource Sharing.

UNIT-IV: Project Monitoring/Control and Project Performance: Planning, Monitoring and Control; Design of monitoring system; Computerized PMIS (Project Management Information System). Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control, Performance Indicators; Project Audit; Life Cycle, Responsibilities of Evaluator/ Auditor, Responsibilities of the Project Manager.

Recommended Books:

1. Chandra, P. (2017). Projects: Preparation, Appraisal, Budgeting and Implementation. 8th Edition, Tata Mcgraw.

2. Desai, V. (2017). Project Management and Entreprenueurship. 2nd Edition, Himalaya Publishing House.

3. Fyffe, D. S. (2001). Project Feasibility Analysis. New York: John Wiley and Sons.

4. Ragaranjan K. (2005). Elements of project Management. 1st Edition, New Age International.

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UC-BTEC-901A-18	Credits	L	T	P	Int	Ext
AC & DC MOTORS	3	3	0	0	40	60

Course Objectives: The Objective of this course is to introduce the ECE undergraduates to basic concepts, constructional features and working of DC, AC and Special motors.

Course Outcomes: After undergoing this course students will be able to

I. Understand the principle of energy conversion.

II. Explain the working principle, construction and applications of DC motors.

III. Explain the working principle, construction and applications of AC motors.

IV. Gain knowledge about the fundamentals of Special motors.

UNIT I: Introduction Energy conversion principle

Concept of co-energy, Coupling-field reaction for energy conversion, Mechanical work, Mechanical forces and torques in singly and doubly excited systems. Concepts of reluctance and electromagnetic torques. Singly excited electric field systems.

UNIT II: DC Motors

Constructional features and principle of working, Function of the Commutator for motoring and generating action, Types of armature winding, factors determining induced e.m.f., Factors determining electromagnetic torque, Relationship between terminal Voltage and induced e.m.f. for different DC machines, Factors determining Speed of DC motors, Speed control methods, Performance Characteristics of different DC Machines(working as motors and generators), Starting of DC motors and starters, Application of DC motors.

UNIT III: AC Motors

Brief introduction about three phase induction motors, Principle of operation, Types of induction Motors and constructional feature of squirrel cage and slip ring motors, Starting of three phase induction motors: Star Delta and DOL (direct-on-line) starters, Reversal of direction of rotation of three motors, Application of Induction Motors, Introduction of Synchronous Machines, alternators and its principle of operation, Synchronous motors and their applications.

UNIT IV: Special Motors

Single phase synchronous motors, Reluctance motors, Hysteresis motors, Linear induction motor, stepper motors, step angle, variable reluctance stepper motor, Permanent magnet stepper motor, Detent torque, Hybrid stepper motor, Torque-pulse rate characteristics, Applications of stepping motors, Permanent magnet DC motors, printed circuit board motors.

Recommended Text and Reference Books

1. P. S. Bimbhra, Electrical Machinery, Khanna Publications.
2. P.S. Bimbhra, Generalized Theory of Electrical machines, Khanna Publications.
3. Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill.
4. Ashfaq Hussain, Electric Machines, Dhanpat Rai & Co.

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UC-BTEC-901C-18 SATELLITE COMMUNICATION	Credits	L	T	P	Int	Ext
	3	3	0	0	40	60

Course Objectives

This course presents the fundamentals of satellite communications link design and an in-depth knowledge of practical considerations. After going through this course they will have better understanding of unique challenges of designing, developing and operating satellite communications systems.

Course Outcomes

After undergoing this course students will be able to

I. Interpret & define basics of Satellite communication, understand the complete link design along with and the interference effects on it.
II. Understand various fixed and demand assignment multiple access techniques.
III. Understand the special purpose communication satellites.
IV. Have knowledge of laser satellite communication and CATV system.

Unit I: Introduction to Satellite Communication

Evolution and growth of communication satellite, Advantages of satellite communication, Active & Passive satellite, Orbital aspects and their effects on satellite communications.

Unit II: Satellite Link Design

Basic transmission theory, Link design equation, System noise temperature, C/N & G/T ratio, Atmospheric & ionospheric effects on link design, Uplink design, Complete link design, Interference effects on complete link design, Earth station parameters, Earth space propagation effects, Frequency window, Free space loss, Atmospheric absorption, Rainfall Attenuation, Ionospheric scintillation, Telemetry, Tracking and command of satellites.

Unit III: Fixed and Demand Assignment Multiple Access Systems

FDMA techniques, SCPC & CSSB systems, TDMA frame structure, Burst structure, Frame efficiency, Super-frame, Frame acquisition & synchronization, TDMA vs FDMA, Burst time plan, Beam hopping, Satellite switched, Erlang call congestion formula, DA-FDMA, DA-TDMA.

Unit IV: Special Purpose Communication Satellites

INTELSAT, INSAT Series, VSAT, Weather forecasting, Remote sensing, LANDSAT, Satellite Navigation, Mobile satellite Service, Defence satellites.

Unit V: Laser Satellite Communication and CATV System

Link analysis, Optical satellite link Tx & Rx, Satellite beam acquisition, Tracking & pointing, Cable channel frequency, Head end equation, Distribution of signal, Network specifications and architecture, Optical fibre CATV system.

Recommended Text and Reference Books

1. Trimothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons.
2. Dr. D.C. Aggarwal, Satellite Communications, Khanna Publishers.
3. Dennis Roddy, Satellite Communications, McGraw Hill. 4. K.N. Raja Rao, Fundamentals of Satellite Communications, Prentice Hall India Learning Private Limited.

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3. Bart Kosko, Neural Networks & Fuzzy Logic, Prentice Hall.
4. Simon S. Haykin, Neural Networks, Prentice Hall.

UC-BTEC-901F-18 JAVA Programming	Credits	L	T	P	Int	Ext
	3	3	0	0	40	60

Course Outcomes

After this course the students will be able to:

1. Apply the concepts and basics of JAVA
2. Demonstrate the knowledge of operators and control statements
3. Ability to learn about Inheritance, Interface, Applets.
4. Learn about JAVA database connectivity

Introduction to Java: History of Java, Features of Java, Java Development Kit (JDK), Security in Java, Java Basics: Keywords; Working of Java; Including Comments; Data Types in Java; Primitive Data Types; Abstract / Derived Data Types; Variables in Java; Using Classes in Java; Declaring Methods in Java, Code to Display Test Value; The main () Method, Invoking a Method in Java; Saving, Compiling and Executing Java Programs

Operators and Control Statements: Operators, Arithmetic Operators, Increment and Decrement Operators, Comparison Operators, Logical Operators, Operator Precedence; Control Flow Statements, If-else Statement, Switch Statement, For Loop, While Loop, Do…While Loop, Break Statement Continue Statement Arrays and Strings: Arrays; String Handling; Special String Operations; Character Extraction; String Comparison; Searching Strings; String Modification; String Buffer

Inheritance, Package and Interface: Inheritance, Types of Relationships, What is Inheritance?, Significance of Generalization, Inheritance in Java, Access Specifiers, The Abstract Class; Packages, Defining a Package, CLASSPATH; Interface, Defining an Interface, Some Uses of Interfaces, Interfaces versus Abstract Classes Exception Handling: Definition of an Exception; Exception Classes; Common Exceptions; Exception Handling Techniques, Streams in Java: Streams Basics; The Abstract Streams; Stream Classes; Readers and Writers; Random Access Files; Serialization

Applets: What are Applets?; The Applet Class; The Applet and HTML; Life Cycle of an Applet; The Graphics Class; Painting the Applet; User Interfaces for Applet; Adding Components to user interface; AWT (Abstract Windowing Toolkit) Control, Event Handling: Components of an Event; Event Classes; Event Listener; Event-Handling; Adapter Classes; Inner Classes; Anonymous Classes, Swing: Concepts of Swing; Java Foundation Class (JFC)

Java Data Base Connectivity: Java Data Base Connectivity; Database Management; Mechanism for connecting to a back end database; Loading the ODBC driver, RMI, CORBA and Java Beans: Remote Method Invocation (RMI); RMI Terminology; Common Object Request Broker Architecture (CORBA), Java IDL

Recommended Books:

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1. Programming with Java A Primer, 5th Edition, E. Balagurusamy, Tata Mcgraw Hill.
2. Java Programming for Core and Advanced Learners, Sagayaraja, Denis, Karthik, Gajalakshmi, Universities Press.
3. Java Fundamentals, A Comprehensive Introduction, H. Schildt, D. Skrien, Tata McGraw Hill.
4. Java, The complete Reference, H. Schildt, 7th Edition, Tata McGraw Hill.

UC-BTEC-511-18 Analog and Digital Communication Laboratory	Credits	L	T	P	Int	Ext
	1	0	0	2	30	20

Course Objective

This laboratory course deals with the Hands-on experiments related to the study and investigate the outputs of various Analog and digital modulation techniques.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Study and verify the characteristics and output waveforms of AM, FM, PCM
2. Study and compare noise in AM and FM systems
3. Investigate the output responses of PAM, PCM, PSK, FSK, MSK.

List of Experiments:

1. To study the Characteristics/output waveform of Amplitude Modulation and demodulation techniques.
2. To Investigate and compare the outputs of SSB, DSB-SC and VSB Modulation systems.
3. To study and compare Noise Interference in AM and FM systems.
4. To study the effect of threshold in Angle modulation.
5. To study the effect of Sampling and Investigate the Output response of Pulse Amplitude Modulation.
6. To Investigate the Output response of Pulse Code Modulation.
7. To Study the output response of PSK & FSK.
8. To Study Delta modulation and demodulation technique and observe effect of slope overload.
9. To study the output response of QAM.
10. To study the output response of Continuous Phase Modulation.
11. To study the output response of Minimum Shift keying.
12. Digital link simulation; error introduction & error estimation in a digital link using MATLAB (SIMULINK)/ communication simulation packages.

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UC-BTEC-512-18	Credits	L	T	P	Int	Ext
Digital Signal Processing Laboratory	1	0	0	2	30	20

Course Objective

This laboratory course deals with the Hands-on experiments related to the study of Digital Signal Processing and its applications.

Course Outcomes

At the end of this course student will demonstrate the ability to:
1. Write programs to develop various signals.
2. Write programs to generate standard sequences.
3. Develop programs to verify convolution
4. Develop programs to design various filters.

List of Experiments: Perform the following exercises using MATLAB

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
2. Write a program in MATLAB to generate standard sequences.
3. Write a program in MATLAB to compute power density spectrum of a sequence.
4. To develop program modules based on operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.
5. To develop program for finding magnitude and phase response of LTI system described by system function H(z).
6. To write a MATLAB programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.

List of Lab Experiments on hardware: (using C6xxx board, Code composer studio and Acarya app)

7. Implementation Linear and Circular Convolution
8. To Find DFT and IDFT of given time DT Signal
9. N point FFT Algorithm implementation
10. Digital Filter Design - FIR Filter Implementation
11. Digital Filter Design - IIR Filter Implementation
12. Configuring Audio Codec of C6xxx Boards
13. Configuration of Audio Input and Output Channels (Loopback/Talkback using Acarya Application)
14. Implementation of Audio Delay Line, Echo and Audio Reverberation
15. Applications - Digital Signal Generations
16. Moving Average filter Design (Noise Cancellation using Acarya Application Reference)

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UC-BTEC-513-18	Credits	L	T	P	Int	Ext
Linear Integrated Circuits Laboratory	1	0	0	2	30	20

Course Objective

This laboratory course deals with the Hands-on experiments related to the study of the concepts of Linear Integrated Circuits.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Study and investigate the configurations of Differential amplifiers.
2. Measure the performance parameters of am OP-Amp.
3. Use Op-Amps for various applications.

List of Experiments (Minimum 12 experiments to be performed):

1. Study differential amplifier configurations.
2. Measure the performance parameters of an Op amp.
3. Application of Op amp as Inverting and Non Inverting amplifier.
4. Study frequency response of an Op Amp and determine Gain-Bandwidth product
5. Application of Op-Amp as summing, scaling & averaging amplifier.
6. Application of Op-Amp as Instrumentation amplifier
7. Design differentiator and Integrator using Op-Amp.
8. Design Low pass, High pass and Band pass 1st order Butterworth active filters using Op-amp
9. Design Phase shift and Wein Bridge oscillator using Op-Amp.
10. Application of Op Amp as square wave, triangular wave and Sawtooth wave generator.
11. Application of Op Amp as Zero Crossing detector and window detector.
12. Application of Op Amp as Schmitt Trigger.
13. Application of 555 as Monostable and Astable multivibrator.
14. Examine the operation of a PLL and determine the free running frequency, the capture range and the lock in range of PLL.

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UC-BTEC-521-18	Credits	L	T	P	Int	Ext
4-Week Industrial Training I	Non-credit	0	0	6	60	40

Minimum of four weeks in an Industry in the area of Electronics and Communication Engineering at the end of 4th Semester. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to the student. The outcome of the internship should be presented in the presence of the Peers and Faculty with a Power point Presentation and submit the hard copy report duly endorsed by the Industry for Evaluation to the Department. A Viva-voce will be conducted.

BMPD-351-18	Credits	L	T	P	Int	Ext
Mentoring and Professional Development*	Non-credit	0	0	2	S/US**	

* As stated in the IKGPTU B.Tech 1st Year Scheme and Syllabus
**S/US - Satisfactory and Unsatisfactory

* Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.

For achieving the above, suggestive list of activities to be conducted are:

Part – A

(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B

(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty in-charges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

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SIXTH SEMESTER

B.Tech.

Electronics & Communication Engineering (ECE)

Syllabus

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Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

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UC-BTEC-601-18	Credits	L	T	P	Int	Ext
Wireless Communication	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to understand the important concepts related to Wireless communication using suitable mathematical models.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1.Understand the basic elements of Cellular Radio Systems and its design
2.Learn about the concepts Digital communication through fading multipath channels
3.Understand various Multiple Access techniques for Wireless communication
4.Know about the Wireless standards and systems

Unit 1: Elements of Cellular Radio Systems Design: Basic cellular system, Performance criteria, Components and Operation of cellular systems, Planning a cellular system, Analog & Digital cellular systems, Concept of frequency reuse channels, Handoff: soft and hard handoff, Co-channel interference, Reduction factor, desired C/I for a normal case in an omni directional antenna system, Cell splitting, Wireless Channel characterization.

Unit 2: Digital Communication through fading multipath channels: Fading channels and their characteristics- Channel modelling, Digital signalling over a frequency non selective slowly fading channel. Concept of diversity branches and signal paths. Combining methods: Selective diversity combining, Switched combining, Maximal ratio combining, Equal gain combining.

Unit 3: Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Basic concepts of Radio Protocols.

Unit 4: Wireless System standards & Emerging technologies: AMPS and ETACS, United states digital cellular (IS- 54 & IS 136), IEEE Standards, Global system for Mobile (GSM): Services, Features, System Architecture and Channel Types, Frame Structure for GSM, Speech Processing in GSM, GPRS/EDGE specifications and features. 3G systems: UMTS & CDMA 2000 standards and specifications. CDMA Digital standard (IS 95): Frequency and Channel specifications, Forward CDMA Channel, Reverse CDMA Channel, Wireless Cable Television, Bluetooth, Zigbee, LTE-Advance systems, 4G & 5G Mobile techniques and Emerging technologies.

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Recommended Books:

1. T.S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education Asia, 2010.

2. William C Y Lee, Mobile Cellular Telecommunications, 2nd Edition, MGH, 2004.

3. Raj Pandya, —Mobile and Personal Communication systems and services‖, Prentice Hall of India, 2001.

4. Wireless and Digital Communications; Dr. Kamilo Feher (PHI), 1998.

UC-BTCS-602-18	Credits	L	T	P	Int	Ext
Computer Networks	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to understand the important concepts related to Computer networking.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1.Explain the functions of the different layer of the OSI Protocol

2.Describe the function of each block of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs)

3.Develop the network programming for a given problem related TCP/IP protocol

4.Learn about DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Unit 1: Data Communication - Data Communication System & its Components, Representation of data and its flow Networks, Various Connection Topologies, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization.

Unit 2: Data Link Layer and Medium Access Sub Layer - Design issues, Framing, Error detection and correction codes: checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP

Unit 3: Network Layer Switching - Logical addressing IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Unit 4: Transport and Application Layer - User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm, Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), World wide web (WWW), HTTP, SNMP, Bluetooth, Firewalls, Introduction to network security.

Recommended Books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw- Hill 2007.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India 2007.
3. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition 2013.
4. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India 2015.
5. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, USA 2012 .

UC-BTEC-603-18	Credits	L	T	P	Int	Ext
Optical Fibres and Communication	4	3	1	0	40	60

Course Objective

This is one of the fundamental courses meant to understand the important concepts related to Optical Fibres and Communication.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1.Understand the basics of Optical Communication and Optical fibres
2.Learn about the Optical Transmitters and Receivers
3.Explain the Light wave Architecture and systems
4.Ability to explain the modulation in Optical Communication

Unit 1: Introduction

Introduction to Telecommunications and fiber optics, Evolution of Light wave Systems, Need of Fiber Optic Communications, point to point systems and Networks, Information carrying capacity, Basic block diagram of fiber optic communication systems: Optical Communication Systems, Light wave System Components; Optical Fibers as a Communication Channel, Optical Transmitters, Optical Receivers.

Unit 2: Optical Fibers

Optical fiber description: How optical fiber conducts light, core cladding, Total internal reflection, Fiber Modes, Dispersion in Single-Mode Fibers, Modal dispersion, Step-Index Fibers, Graded Index Fibers, Understanding Numerical Aperture, Acceptance cone. Attenuation, bending losses, scattering, absorption, total attenuation, Bit rate and bandwidth, Cables, Connectors and Splicing.

Unit 3: Optical Sources and Detectors

Basic Concepts; Emission and Absorption concept in p-n Junctions, non-radiative Recombination, Semi-conductor Materials, Light Emitting Diodes; Light radiation by a semiconductor, Power-current Characteristics, LED Structures, Semi-Conductor Lasers Diodes; Principle of action, DFB Lasers, Coupled Cavity semiconductor Lasers, Vertical Cavity Semiconductor Lasers, Laser Characteristics. Basic concepts of detectors, p-n Photo Diodes, p-i-n Photo Diodes, Avalanche Photo Diode, Receiver Design, Receiver Noise; Noise mechanism, Receiver sensitivity; Bit error rate, Minimum Receiver Power.

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Unit 4: Light Wave Systems

Overview: System Architecture, Components of fiber optic Networks, point to point links, Optical Amplifiers, Principle of operation, Wavelength Division Multiplexers and Demultiplexers, Semiconductor optical amplifiers, Erbium doped fiber amplifiers, Dispersion limited Light wave systems, Optical TDM Systems, Network Management and future of fiber optic Networks, Introduction to all optical networks.

Recommended Books:

1. Senior J. Optical Fiber Communications, Principles & Practice, PHI 1985.
2. Keiser G., Optical Fiber Communication, Mc Graw-hill 2008.
3. Govind P. Agrawal, Fiber Optics Communication Systems, John Wiley & Sons (Asia) Pvt. Ltd 1998.
4. Djafar K. Mynbeav, Fiber-Optics Communications Technology, Pearson 2001.

UC-BTEC-604-18	Credits	L	T	P	Int	Ext
Microwave and Antenna Engineering	4	3	1	0	40	60

Course Objective

This is one of the fundamental courses meant to understand the important concepts related to Microwave and Antenna Engineering.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1.Understand the working and operation of various Microwave Tubes and Microwave Solid-state devices.

2.Learn about various important Microwave Components and the Microwave measurements that can be carried out.

3.Explain the basic concepts and types of Antennas and its regions.

4.Describe the important concepts of Antenna Arrays and Antenna Aperture.

Unit 1: Microwave Tubes and Solid-State devices: Limitations of Conventional tubes, construction, Operation and properties of Klystron Amplifier, reflex Klystron, Magnetron, Travelling Wave Tube (TWT), Backward Wave Oscillator (BWO), Crossed field amplifiers. Microwaves Transistors: (Bipolar, FET), Transferred Electron Devices (Gunn diode), Avalanche transit time effect (IMPATT, TRAPATT), Microwave Amplification by Stimulated Emission of Radiation (MASER).

Unit 2: Microwave Components and Measurements: Analysis of Microwave components using S-parameters, Junctions (E, H, Hybrid), Directional coupler, Bends and Corners, Microwave posts, S.S. tuners, Attenuators, Phase shifter, Ferrite devices (Isolator, Circulator, Gyrator), Cavity resonator, Matched termination. Power measurements using calorimeters and bolometers, Measurement of Standing Wave Ratio (SWR), Frequency and wavelength.

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Unit 3: Antennas: Concept of radiation in Single wire, Two wire, and Dipole, Introduction to Antenna parameters: Reflection Co-efficient, VSWR, Radiation pattern, Directivity, Gain. Infinitesimal dipole, Short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field regions, Monopole and Half wave dipole, Microstrip Patch & Fractal Antennas.

Unit 4: Antenna Arrays and Aperture Antennas: Array of two-point sources, Array factor, Array configurations, Hansen-woodyard end fire array, n-element linear array with uniform amplitude and spacing, n-element linear array with non-uniform spacing, Binomial and Dolph-Tschebysceff array, Scanning Arrays. Aperture Antennas: Rectangular and circular aperture antennas, Horn antenna, Babinet's Principle, Slot Antenna, Loop antenna.

Recommended Books:

1. M.Kulkarni, Microwave and Radar Engineering, Umesh Publications, 5th Edition, 2018.
2. Jordan E.C., Electromagnetics and radiating systems, PHI 1995.
3. J.D.Krauss, Antenna Theory, McGraw Hill 1999.
4. C.A.Balanis, Antenna Theory, John Wiley & sons 4th Edition 2016.
5. R.L.Yadava, Antenna and wave propagation, PHI 2011

UC-BTEC-902B-18	Credits	L	T	P	Int	Ext
Power Electronics	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to recall concepts of Power Electronics and understand the behaviour and working of power semiconductor devices using mathematical models.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Attain the ability and to handle the concept of construction and characteristics of Power semiconductor devices and fundamental of thyristors and family.
2. Demonstrate and build a various single phase AC-DC power converter circuits and understand their applications.
3. Illustrate the operating principle and construct a various types of DC-DC converters.
4. Simulate power electronic converters and their control scheme.

Unit 1: Power Semiconductor Devices

Construction and Characteristics of Power diodes, Power Transistors, Power MOSFET, Insulated Gate Bipolar transistors (IGBTs), Introduction to Thyristor family: SCR, DIACs, TRIACs, Light Activated SCRs (LASCRs), Reverse Conducting Thyristor , (RCT), Asymmetrical SCR (ASCR), Gate turn off Thyristors (GTOs), Integrated Gate Commutated Thyristors (IGCTs), MOS controlled Thyristors (MCTs) Power Integrated circuits (PICs), Intelligent Modules

Unit 2: Thyristor Fundamentals

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Construction of SCR, Operating modes, Two transistor analogy, Static & dynamic characteristics, Gate characteristics, Turn on & turn off methods (Commutation methods), Series and Parallel operations of SCRs : Need, String efficiency, Issues, Static and Dynamic Equalizing circuit and Means to minimize the effect of mismatch Isolation of gate and base drive using pulse transformer and Opto-couplers, Gate Drive/Triggering circuits: R trigger, RC trigger, Cosine Triggering, UJT and Programmable UJT as an oscillator and triggering circuit based on them Ratings, Cooling and Heat sinks, Thermal Modeling, di/dt and dv/dt protection, Electro Magnetic Interference(EMI) and Shielding.

Unit 3: Phase Controlled (AC to DC) Converters

Review of half wave and full wave diode rectifier (with RL load); Principle of phase controlled converter operation; Operation of 1 phase half wave converter with R, RL and RLE load; Significance of freewheeling diode ; 1 phase full wave converter: Center tapped and Bridge Configuration; Operation and analysis with R,RL, RLE load; Analysis; 3 phase converters : Operation of half wave converter; Full wave fully controlled converters: Analysis and operation with different type of loads; Rectification and Inversion Mode; Semi controlled converter; Dual Converter: Principle and operation; 1 phase and 3 phase configurations; Simultaneous and Non simultaneous operation

Unit 4: DC Drives to DC Converters

The chopper, Basic principle of DC chopper, Classification of DC choppers, Control strategies, Basic DC-DC converter (switch regulator) topologies : Principle, operation and analysis for Step-down (Buck), Step-up (Boost), Step up/down (Buck-Boost), Continuous conduction and Discontinuous conduction operation, Basic characteristics of DC motors, Two zone operation, Four quadrant operation (Operating modes), Principles of DC motor speed control Single phase separately excited drives: Half Wave converter, Semi-converter and Fully Controlled converter based drives; Braking operation of separately excited drive. Principle of power control (motoring control) of separately excited and series motor with DC-DC Converter; Steady-state analysis

Recommended Books

1. M D Singh and K B Khanchandani, "Power electronics", TMH, New Delhi.
2. P.T. Krein, "Elements of Power Electronics"", Oxford University Press.
3. Muhammad H. Rashid, "Power Electronics Circuits, Devices and Applications", Prentice Hall of India, 3rd edition.
4. Ned Mohan, Undeland and Robbins, "Power Electronics Converters, Applications and Design", John Willey & sons.

UC-BTEC-902C-18	Credits	L	T	P	Int	Ext
Mobile Adhoc Networks	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to explore various components of mobile adhoc networks with its Protocol Design and its security's importance. a

Course Outcomes

At the end of this course students will demonstrate the ability to

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1. Understand the principles of mobile ad hoc networks, and their models.
2. Understand and develop information dissemination protocols for mobile adhoc networks
3. Analyze the challenges in designing, routing and security in mobile adhoc networks.

Unit 1: Introduction to ad-hoc networks

Introduction, characteristics, features and applications of ad-hoc networks. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoor models.

Unit 2: Medium Access Protocols

Design issues, goals and classification. Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

Unit 3: Network Protocols

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

Unit 4: End Delivery, Security and Cross Layer Design

Transport Layer: Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols. Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

Recommended Books

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad-hoc networking, Wiley-IEEE press, 2004. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach" 1st Edition, VPT, 2014
2. T. Camp, J. Boleng, and V. Davies " A Survey of Mobility Models for Ad-hoc Network"
3. Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 2002.
4. A survey of integrating IP mobility protocols and Mobile Ad-hoc networks, Fekri M. bduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, no: 12007.

UC-BTEC-902E-18	Credits	L	T	P	Int	Ext
Artificial Neural Networks	3	3	0	0	40	60

Course Objective

The objective of this course is to provide students with a basic understanding of the fundamentals and applications of artificial neural networks

Course Outcomes

At the end of this course students will demonstrate the ability to:

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4. Understand generic machine learning terminology.
5. Understand the mathematical foundations of neural network models
6. Have a broad knowledge in Fuzzy logic principles and will be able to determine different methods of Defuzzification.

Unit 1: Fundamental Concepts of Artificial Neural Networks

Models of ANNs; Feedforward & feedback networks; learning rules; Hebbian learning rule, perception learning rule, delta learning rule, Widrow-Hoff learning rule, correction learning rule, Winner –lake all elarning rule, etc.

Unit 2: Single layer Perception Classifier

Classification model, Features & Decision regions; training & classification using discrete perceptron, algorithm, single layer continuous perceptron networks for linearly separable classifications.

Unit 3: Multi-layer Feed forward Networks

Linearly non-separable pattern classification, Delta learning rule for multi-perceptron layer, Generalized delta learning rule, Error back-propagation training, learning factors, Examples.

Unit 4: Associative memories

Linear Association, Basic Concepts of recurrent Auto associative memory: retrieval algorithm, storage algorithm; By directional associative memory, Architecture, Association encoding & decoding, Stability.

Unit 5: Self organizing networks

UN supervised learning of clusters, winner-take-all learning, recall mode, Initialisation of weights, seperability limitations.

Recommended Books

1. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
2. Neural Networks,Fuzzy Logic and Genetic Algorithms, by S.Rajasekaran and G.A. Vijayalakshmi Pai.
3. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
4. Machine Learning by Tom Mitchell, McGraw-Hill Press, 1997

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UC-BTEC-611-18	Credits	L	T	P	Int	Ext
Optical Fibres and Communication Lab	1	0	0	2	30	20

Course Objective

This is one of the experimental courses meant to understand the important concepts related to Optical Fibres and Communication.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. To perform experiments based on optical communication in order to understand in depth concepts of latest communication system.
2. To study various types of optical sources and light detectors
3. To know methods of slicing and connecting techniques of optical fibres
4. To study different types of losses in optical fibres.
5. To know applications of optical fibres.

List of Experiments:

The student has to perform 8 to 10 Lab experiments from the below:

1. Study and measurement of Attenuation and Loss in optical fibre.
2. Study and measurement of bending loss in optical fibre.
3. Study and measurement of numerical aperture of optical fibre.
4. Measurement of optical power using optical power meter.
5. To Study the transmission of TDM signal through optical fibre.
6. To determine the bit rate of the optical fibre link.
7. Study of various multiplexing techniques.
8. To determine the BER of wireless system using M-ARY (BPSK,QPSK,8PSK,16PSK) and QAM technique.
9. To learn fibre splicing techniques and to become familiar with the use of optical time domain reflectometry in characterizing optical fibres.
10. To establish fibre optic analog link and to study the relationship between the input signal & received signal.
11. To study the VI characteristics of fibre optic source and Photo Detector.
12. Simulation of an optical communication system & calculation of its BER and Q factor using simulator.

UC-BTEC-612-18	Credits	L	T	P	Int	Ext
Microwave and Antenna Engineering Lab	1	0	0	2	30	20

Course Objective

This is basic course meant to give hands on experience of various types of Microwave components and important measurements related to Microwave and Antenna Engineering.

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Course Outcomes

At the end of this course students will demonstrate the ability to:
1. Learn about general Microwave components and Microwave bench.
2. Measure common parameters related to Microwave Oscillator(s).
3. Determine frequency and wavelength of waveguides.
3. Measure and plot radiation patterns of various types of Antennas.

List of Experiments:

The student has to perform 8 to 10 Experiments from the below:
1. To study various Microwave Components and Instruments.
2. To study the V-I Characteristics of Gunn Diode Oscillator at X-band.
3. To study Output power and Frequency as a function of voltage using Gunn Diode Oscillator at X-band.
4. To Study the characteristics of a Reflex Klystron oscillator.
5. To determine the Standing Wave Ratio (SWR) and Voltage standing wave ratio (VSWR).
6. To measure the dielectric constant of a material at X-band.
7. To determine the frequency & wavelength in a rectangular waveguide.
8. Measurement of coupling factor and Isolation of a Directional coupler using X-band.
9. To measure the Attenuation/Insertion Loss of an attenuator.
10. Determination of the phase-shift of a phase shifter.
11. To plot the Radiation pattern of an antenna.
12. To study Simple Dipole ($\lambda/2$ or $\lambda/4$ or $3\lambda/2$) antenna (all or any of these single dipole antennas) and Folded Dipole $\lambda/2$ antenna.
13. To study 3/5/7-element Yagi-Uda Folded Dipole antenna.
14. To study the Radiation pattern, Gain, Directivity of a Slot/Loop Antenna.

UC-BTEC-631-18	Credits	L	T	P	Int	Ext
Project – I	3	0	0	3	60	40

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor.

This is expected to provide a good initiation for the student(s) in R&D work. The assignment may normally include:
1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

The students shall have to design two Projects (i.e. Project-I and Project-II in 6th Semester and 7th Semester, respectively). The projects must involve originality, innovation and business idea. Assessment will be based on the work performance & report submitted.

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UC-BMPD-361-18	Credits	L	T	P	Int	Ext
Mentoring and Professional Development*	Non-credit	0	0	2	S/US**	

* As stated in the IKGPTU B.Tech 1st Year Scheme and Syllabus
**S/US - Satisfactory and Unsatisfactory

* Guidelines regarding Mentoring and Professional Development
The objective of mentoring will be development of:
- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

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SEVENTH/EIGHTH SEMESTER

B.Tech.

Electronics & Communication Engineering (ECE)

Syllabus

IKGujral Punjab Technical University

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Professional Electives

BTEC-907A-18	Credits	L	T	P	Int	Ext
Internet Of Things (IOT) & Cloud Computing	3	3	0	0	40	60

Course Objective:
The main objective of this course is to enlighten the students with the basic concepts of Internet of Things (IoT) & Cloud Computing along with the services and application by their types which would facilitate to the humans to solve the real world problems.

Course Outcomes:
After completion of the course, the students would able to:
1. Understanding concept of cloud computing and analyze trade-off between deploying application on cloud and using local infrastructure

2.Identify issues and design challenges in IoT applications.

1. Select appropriate hardware and software components for IoT applications.
2. Conceptual knowledge will help students to build IOT applications.

Unit-I Introduction & Overview of Internet of things - The Internet of things today and tomorrow, Vision of internet of things, An IoT architecture outline ,Functional blocks of IOT ,industrial IOT, IOT enabled Smart devices in market, Application areas for IOT, Challenges in IOT. Hardware and Software tools required for IOT application development, Overview of IOT based on Texas instruments Hardware platforms and IDE's for development.

Unit- II Internet/Web and Networking Basics - Introduction to Internet & network topologies, TCP/IP protocol, TCP/IP Layers and their relative Protocols, IP addressing(IPV4), IP Address Classification & Subnetting, Local IP , Gateway IP and DNS,TCP & UDP Communication, Access point and Station model, Wireless networks, Encryption standards and signal strength of WiFi network, Overview of MAC Address, Energia WiFi Library API's .

Case Study : Connected microcontrollers essential to automation in buildings.

Unit-III Web servers and Client Communication- Introduction to a Web server and its types, Role of servers over internet, Port numbers, Socket Communication, WiFi Web Client, Client server Communication model with Example, Overview of HTTP protocol, HTTP based web server, Sensor interfacing with network, basics of HTML, Client and Server class API's.

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Unit-IV Cloud Communication in IOT- IOT device to cloud storage communication Model, need of Cloud services in IOT, ,Different Cloud storage services available today, Cloud Data processing and frame format, Role of Smart phones in IOT, Examples on Home automation and Smart city development, Introduction to clouds like Temboo, Blynk, Pubnub etc.

Case Study : Advances in bio-inspired sensing help people lead healthier lives.

Unit-V IOT Plate form and Application development- Remote Monitoring & Sensing, Remote Controlling, Application development using MQTT Protocol, Sensors and sensor Node and interfacing using Embedded target boards (TM4C123x & CC31xx), IoT applications in home, infrastructures, Healthcare, Transport, buildings, security, Industries, and other IoT electronic equipment, Adapting IPV6 for IOT Requirement (overview).

Suggested Books

1. Dr. Ovidiu Vermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrate Ecosystems, River Publishers 2010.
2. Jan Axelson, Embedded Ethernet And Internet Complete (Designing and Programming Small Devices for Networking) 2014.
3. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach, McGraw Hill 2013.
4. Jean-Philippe Vasseur,Adam Dunkels, Morgan Kuffmann. Interconnecting Smart Objects with IP: The Next Internet,
5. Raj Kumar Buyya, James Broberg, Cloud Computing: Principles and paradigms 2000.
6. Barrie Sosinsky, Cloud Computing Bible, Wiley Publications 1999.
7. Ricardo Puttini, Thomas Erl, and Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Tata MacGrawHill 1997.

References

1. http://www.ti.com/ww/en/internet_of_things/iot-overview.html.
2. http://energia.nu/reference/
3. *Internet of Things (IoT): A vision, architectural elements, and future directions Jayavardhana Gubbia, Rajkumar Buyyab, *, Slaven Marusic a, Marimuthu Palaniswami a*
4. http://www.ti.com/wireless-connectivity/simplelink-solutions/overview/overview.html.
5. https://www.hivemq.com/blog/mqtt-essentials-part2-publish-subscribe.

BTEC-907C-18	Credits	L	T	P	Int	Ext
Robotics and Embedded Systems	3	3	0	0	40	60

Course Objective:
The main objective of this course is to enlighten the students with the basic fundamentals of Robotics, Robotic Transformation, Simulation and programming along with the Embedded

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systems in Robotics so that they will be able to design the robots which would facilitate to the humans to solve the real world problems.

1. Ability to understand basic concept of robotics.
2. To analyze Instrumentation systems and their applications to various
3. To know about the differential motion, add statics in robotics
4. To know about the various path planning techniques.
5. To know about the dynamics and control in robotics industries.

UNIT I - BASIC CONCEPTS

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues-Various manipulators–Sensors-work cell-Programming languages.

UNIT II - DIRECT AND INVERSE KINEMATICS

Mathematical representation of Robots-Position and orientation–Homogeneous Transformation-Various Joints-Representation using the Denavit Hattenberg parameters-Degrees of freedom-Direct Kinematics-Inverse kinematics-SCARA robots-Solvability–Solution Methods-Closed form solution.

UNIT III - MANIPULATOR DIFFERENTIAL MOTION AND STATICS

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse-Wrist and arm singularity-Static Analysis-Force and moment Balance.

UNIT IV - PATH PLANNING

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique-Parametric Descriptions-Straight line and circular paths-Position and orientation planning.

UNIT V - ROBOTICS SYSTEM DESIGN

Running Code on Microcontroller-Voltage, Current and power-ARM Cortex M-Software Design-Battery and Voltage Regulation-GPIO-Interfacing Input and Output-DC Motors-Timers-Bluetooth Low Energy.

Suggested Books:

1.R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.

2.JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education,2009.

3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-HillSingapore, 1996.

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4. Jonathan W. Valvano, Embedded Systems: Introduction to Robotics, First Edition,2019
5. TI Robotic System Design Lab-RSLK (https://university.ti.com/en/faculty/ti-robotics-system-learning-kit/ti-robotics-system-learning-kit)

BTEC-908C-18	Credits	L	T	P	Int	Ext
VLSI Design	3	3	0	0	40	60

Course Objectives

This course deals with knowledge and background required for better understanding of VLSI Design and its concepts.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the concepts and various processes related to VLSI
2. Understand the VLSI Circuit Design processes and Gate level design
3. Learn about VHDL Synthesis and the tools involved
4. Describe about CMOS Testing techniques

Unit 1: Introduction to VLSI & Basic Electrical properties - IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies-Oxidation, Lithography, Diffusion, Ion implantation, Metallisation, Encapsulation Probe testing, Integrated Resistors and Capacitors. Electrical Properties of MOS and BiCMOS Circuits: I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage, Body effect, g_m, g_{ds}, Figure of merit, Pass-transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Invertor.

Unit 2: VLSI Circuit Design Processes - VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 m CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Unit 3: Gate Level Design - Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations: Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-In/Fan-out.

Unit 4: VHDL Synthesis - VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools, Test Principles.

Unit 5: CMOS TESTING – Design for manufacturability, Introduction to CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

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Recommended Books:

1.Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition.

2. CMOS Digital Integrated Circuits Analysis & Design, S M Kang and Y Leblebici, McGraaw-Hill, Third Edition.

3.Principles of CMOS VLSI Design – Weste and Eshraghian, Pearson Education, 1999.
4.Chip Design for Submicron VLSI: CMOS Layout & Simulation, – John P. Uyemura, Thomson Learning.

5.Introduction to VLSI Circuits and Systems – John .P. Uyemura, JohnWiley, 2003.
6.Digital Integrated Circuits – John M. Rabaey, PHI, EEE, 1997.
7.Modern VLSI Design – Wayne Wolf, Pearson Education, 3rd Edition, 1997.
8. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

BTEC-909C-18	Credits	L	T	P	Int	Ext
Embedded System Design	3	3	0	0	40	60

Course Objectives

This course deals with the concepts and design requirements for understanding the Embedded System Design and its fundamentals.

Course Outcomes

After the completion of this course, the student will be able to

- Learn about the basic architecture of 32-bit microcontrollers
- Understand hardware interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
- Reviews and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
- Understand Embedded Networking concepts based upon connected MCUs

UNIT-I: Introduction to Embedded systems

Embedded system overview and applications, features and architecture considerations-ROM, RAM, timers, data and address bus, Memory and I/O interfacing concepts, memory mapped I/O. CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture, instruction set, instruction formats, and various addressing modes of 32-bit. Fixed point and Floating point arithmetic operations.

Introduction ARM architecture and Cortex – M series, Introduction to the Tiva family viz. TM4C123x(Cortex M4F) and its targeted applications, block diagram, address space, on-chip peripherals (Analog and Digital) Register sets, Addressing modes and instruction set basics.

UNIT-II: Microcontroller Fundamentals for Basic Programming

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I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Introduction to Interrupts, Interrupt vector table, interrupt programming.

UNIT- III: Timers, PWM and Mixed Signals Processing

Timer, Basic Timer, Real Time Clock (RTC), Timing generation and measurements, Analog interfacing and data acquisition: ADC, Analog Comparators, DMA, Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

UNIT-IV: Communication protocols and Interfacing with external devices

Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, I2C protocol, SPI protocol & UART protocol. Implementing and programming I2C, SPI & UART interface and CAN & USB interfaces on TM4C123x .

UNIT V: Embedded networking

Embedded Networking fundamentals, Ethernet, TCP/IP introduction, Overview of wireless sensor networks and design examples. Various wireless protocols and its applications: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi.

Recommended Books:

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

BTEC-909E-18	Credits	L	T	P	Int	Ext
Biomedical Signal Processing	3	3	0	0	40	60

Course Objectives

The main objective of this course is to enlighten the students with the basic fundamentals and concepts of Biomedical Signal Processing.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the fundamentals of signal processing for various bio-signal analysis
2. Learn the Infinite impulse response (IIR) filter and study its applications
3. Attain in-depth knowledge about the basic concepts of finite impulse response (FIR) filter and study its applications

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4. Apply different methods of signal processing techniques in analyzing the various bio-signals such as Electro cardiogram (ECG), Electro myogram (EMG) and Phonocardiogram (PCG)

Unit 1: Fundamentals of Biomedical Signal Processing (BSP) - Different types of Bioelectric signals and its basic characteristics, Sampling and aliasing, simple signal conversion systems, spectral analysis, FFT - Decimation in Time algorithm and Frequency algorithm.

Unit 2: IIR and FIR Digital Filter Design and Application - Characteristics of IIR and FIR filters, Impulse invariant method, Design of Bilinear transformation and Impulse invariant method using Butterworth technique, Design of Bilinear transformation and Impulse invariant method using Chebyshev technique, Warping and pre-warping effect, Fequency transformation, FIR filter design using windowing techniques- Rectangular, Hamming, Hanning, Blackmann Windows, Time domain filters- synchronized averaging, moving average filters.

Unit 3: Analysis of Bio-Signals for Signal Processing - P-Wave detection, QRS complex detection-derivative based method, Pan Tompkins algorithm, Template matching method, Signal averaged ECG, Analysis of heart rate variability-time domain method and frequency domain methods, Synchronized averaging of PCG envelopes, Envelogram, analysis of PCG signal, EMG signal analysis, ECG rhythm analysis, normal and ectopic ECG beats, analysis of exercise ECG, Analysis of respiration, spectral analysis of EEG signals. Multimedia Applications.

Recommended Books:

1.Rangaraj.M.Rangayyan, Biomedical signal processing, Wiley-IEEE press, 2nd edition, 2015.
2.S.Salivahnan, C.Gnanapriya, Digital signal processing, Tata McGraw-Hill, New Delhi, 2nd edition 2011.
3.John G. Proakis and DimitrisG.Manolakis, Digital signal processing, algorithms and applications, PHI of India Ltd., New Delhi, 4th edition, 2007.
4.Reddy D.C, Biomedical signal processing: Principles and techniques, Tata McGraw-Hill, New Delhi, 2nd edition, 2005.

BTEC-907B-18	Credits	L	T	P	Int	Ext
Antenna Radiating Systems	3	3	0	0	40	60

Course Objectives

This course deals with knowledge and background required for better understanding of Antenna Radiating Systems and its fundamentals.

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Course Outcomes

At the end of the course, students will demonstrate the ability

- To understand the basic concepts of radiation.
- To understand various antenna types.
- To analyse the radiation pattern of antenna arrays.
- To understand the concept of various wave propagation techniques.
- To understand the concept of radiating systems on environment.

Unit 1: Antenna Fundamentals - Power density, directivity, gain, radiation resistance, input impedance, radiation patterns, beam width, bandwidth and polarization. Retarded potential, Matching – Baluns, Polarization mismatch, Antenna noise temperature & SNR, Linear and array antennas - Arrays of two point sources – Broad side and end fire arrays, binomial array - Principle of pattern multiplication –Adaptive arrays.

Unit 2: Fundamentals of Radiation - Radiation from a current element and monopole – Radiation from a Quarter-wave dipole, half-wave and centre-fed dipole – Near and far fields, current distribution of dipole antennas. Radiation from oscillating dipole, Half wave dipole, Folded dipole. Radiation through an Aperture, Radiation from Electromagnetic Horns.

Unit 3: Special Purpose Antennas: (Qualitative treatment only) Loop antennas, Travelling wave antennas, V and rhombic antennas, Horn antennas, Yagi-Uda arrays, Wideband antennas, Log periodic antennas. Babinet's principle – Slot radiators- Parabolic reflectors – Radiation pattern, aperture efficiencies – Feeding techniques for parabolic antennas.

Unit 4: Antenna Measurements - Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods).

Unit 5: Environmental effects - Concept of Electromagnetic interference (EMI); EMC and its advantages. effect of radiating systems on environment, techniques to suppress EMI.

Recommended Books:

1. Constantine A. Balanis, Antenna Theory: Antenna & Design 4th Edition, 2016, Wiley.
2. A. R. Harish, M. Sachidananda, Antennas and Wave Propogation, 2011, Oxford University Press.
3. Edward Conrad Jordan and Keith George Balmain, Electromagnetic Waves and Radiating Systems, PHI.
4. R.L. Yadava, Electromagnetic Waves, Khanna Publishing House, Delhi.
5. A. Das, Sisir K. Das, Microwave Engineering, Tata McGraw Hill.
6. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, Antennas and Wave Propagation, Fourth Edition, 1980, Tata McGraw Hill.

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BTEC-908B-18	Credits	L	T	P	Int	Ext
Mobile Communication and Networks	3	3	0	0	40	60

Course Objectives

This course deals with knowledge and background required for better understanding of Mobile Communication and Networks.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance

Unit 1: Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards, Introduction to Generations – 2G to 5G.

Unit 2: Signal propagation- Propagation mechanism- Reflection, Refraction, Diffraction and Scattering, Large scale signal propagation, Fading channels-Multipath and small scale fading- Doppler shift, Statistical multipath channel models, Narrowband and Wideband fading models, Delay spread, Coherence bandwidth and Coherence time, Flat and frequency selective fading, Slow and Fast fading, Average fade duration and level crossing rate.

Unit 3: Othrogonal Frequency Division Multiplexing (OFDM) – OFDM Receiver & Transmitter structures- Diversity receivers- selection and MRC receivers, RAKE receiver, Equalization, Transmit diversity-Altamonte scheme.

Unit 4: MIMO and Space time signal processing - Spatial multiplexing, diversity/multiplexing tradeoff, Performance measures- Outage, SNR, symbol/bit error rate, examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall,1996.
6. T.S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education Asia, 2010.

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BTEC-908A-18	Credits	L	T	P	Int	Ext
Artificial Intelligence	3	3	0	0	40	60

Course Objective
The main objective of this course is to enlighten the students with the basic fundamentals of Artificial Intelligence Networks, Systems, Methods and parameters.

Course Outcomes
At the end of this course students will demonstrate the ability to:

- Learn about the basic understanding of Artificial Intelligent system
- explain about various types of Artificial Neural Networks & their models
- describe Artificial Neural networks methods, operation and parameters
- explore Neural Network MATLAB Toolbox

Unit 1 - Introduction
Approaches to intelligent control, Architecture of intelligent control, Linguistic reasoning, Rulebase, Knowledge representation.

Unit 2 - Artificial Neural Networks
Biological neuron, Artificial Neural Network (ANN), Mathematical Models, McCulloch Neural Model, Perceptron, Adaline and Madaline, Learning & Training in ANN, Hopfield Neural Network, Self Organizing Networks, Recurrent Networks, Associative memories.

Unit 3 - Fuzzy Logic System
Crisp Vs Fuzzy set theory, Membership functions, Fuzzy set operations, Fuzzy rules, Mamdani and Sugeno fuzzy inference systems, Defuzzification methods.

Unit 4 – ANN Methods and Parameters
Introduction and biological background of GA, String Encoding of chromosomes, Selection methods, Single & multi-point crossover operation, Mutation, Adjustment of strategy parameters such as Population size, Mutation & Crossover probabilities.

Unit 5 – Fuzzy Logic MATLAB Toolbox
Fuzzy Logic Toolbox, Neural Network Toolbox, FLS for Antilock Breaking System (ABS), GA in route planning for Travelling Sales Person, Time-Series forecasting using ANN.

Recommended Books
1. Jacek M. Zurada - Introduction to Artificial Neural Systems, PWS Publishing Company 1995.
2. S N Sivanandam, S N Deepa - Principles of Soft Computing, Wiley Publications, 2007.
3. John Yen, Reza Langari - Fuzzy Logic Intelligence, Control, and Information, Pearson 1998.

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BTEC-909B-18	Credits	L	T	P	Int	Ext
Information Theory and Coding	3	3	0	0	40	60

Course Objectives

This course deals with knowledge and importance with understanding of Information Theory and Coding along with coding techniques.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

Unit 1 – Basic Concepts of Information Theory: The concept of Amount of Information, Average Information, Entropy, Information rate, Shannon's Theorem, Mutual information; Channel capacity; BSC and other channels, Capacity of a Gaussian Channel, Bandwidth - S/N Trade-off, Introduction to Channel Capacity & Coding, Channel Models, Channel Capacity Theorem, Shannon Limit. Huffman source coding algorithm, Lempel Ziv source coding algorithm.

Unit 2 - Introduction to Error Control Coding: Linear Block Codes: Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code. Cyclic Codes: Description of Cyclic codes, Generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes. BCH Codes: Description of codes, Decoding of BCH codes, Implementation of error connection.

Unit 3 - Convolution Codes: Encoding of convolution codes, structural properties of Convolution codes, Distance Properties of convolution codes. Automatic Repeat Request Strategies: Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

Unit 4- Error Control Coding: Concatenated Codes and Turbo Codes, Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes.

Text/Reference Books:

- 1. N. Abramson, Information and Coding, McGraw Hill, 1963.
- 2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

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- 3. R.B. Ash, Information Theory, Prentice Hall, 1970.
- 4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
- Ranjan Bose, Information Theory, Coding and Cryptography, The McGraw Hill, 2007.
- Related IEEE/IEE Publications

BTEC-909D-18	Credits	L	T	P	Int	Ext
Artificial Intelligence &	3	3	0	0	40	60
Machine Learning						

Course Objectives

This course deals with knowledge and background required for better understanding of Artificial Intelligence (AI) and Machine Learning and its issues, challenges and fundamentals. The course actually possesses the ability to apply AI techniques to solve problems of Game Playing, Expert Systems and Machine Learning.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. To learn the difference between optimal reasoning Vs human like reasoning
2.To understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities
3.To learn different knowledge representation techniques
4.To understand the applications of AI namely, Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

Unit –I: Foundations of AI and Intelligent Agents: What is AI, History of AI, Strong and weak AI, The State of the Art. Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit –II: Basic AI Concepts and Machine Learning: Boolean Algebra, Expert Systems, Configuration of Device, Introduction to SWI Prolog, Installing prolog, Introduction to Fuzzy Logic, Basic of ML, Colour Selection Algorithm.

Unit –III: Solving Problems by Searching: Problem –Solving Agents, Example Problems, Searching for Solutions, uniformed search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

Unit –IV: Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World.

Unit –V: Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Learner Models, Nonparametric Models, Support Vector Machines, Ensemble Learning, Practical Machine Learning.

Suggested Text Books:

1."Artificial Intelligence A Modern Approach", Stuart J. Russell & Peter Norvig –Pearson.
2."Artificial Intelligence", Elaine Rich, Kevin Knight & Shivashankar B Nair –McGraw Hill Education.
3.Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier
4. T. Hastie, R. Tibshirani, J. Friedman ---The Elements of Statistical Learning, 2e, 2008.
5. C. Bishop --- Pattern Recognition and Machine Learning. 2e 2010.
6. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
7. E. Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
8. S. Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

BTEC-907D-18	Credits	L	T	P	Int	Ext
Python Programming	3	3	0	0	40	60

Course Objective

The main objective of this course is to enlighten the students with the basic fundamentals of Python programming, its functions & the concept of Eratosthenes.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Read and write simple Python programs.
2. Develop Python programs with conditionals and loops.
3. Define Python functions and to use Python data structures–lists, tuples, dictionaries.
4. Perform input/output operations with files in Python.
5. Execute Searching, sorting and merging in Python.

Unit I: Introduction - The Programming Cycle for Python, Python IDE, Interacting with Python Programs, Elements of Python, Type Conversion. Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression.

Unit 2: Functions - Parts of A Function, Execution of A Function, Keyword and Default Arguments, Scope Rules. String: Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings. Python Data Structure: Tuples, Unpacking Sequences, Lists, Mutable Sequences, List Comprehension, Sets, Dictionaries Higher Order Functions: Treat functions as first class Objects, Lambda Expressions.

Unit 3: Sieve of Eratosthenes - Generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes. File I/O: File input and output operations in Python Programming Exceptions and Assertions

Unit 4: Modules and Classes - Modules: Introduction, Importing Modules, Abstract Data Types: Abstract data types and ADT interface in Python Programming. Classes: Class definition and other operations in the classes, Special Methods (such as _init_, _str_, comparison methods and Arithmetic methods etc.), Class Example, Inheritance, Inheritance and OOP.

Recommended Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/OReilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python-Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press , 2013
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd.,,2015.
6. Kenneth A. Lambert, Fundamentals of Python: First Programsl, CENGAGE Learning, 2012.
7. Charles Dierbach, Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.

BTEC-907E-18	Credits	L	T	P	Int	Ext
Adaptive Signal Processing	3	3	0	0	40	60

Course Objective

The main objective of this course is to enlighten the students with the basic fundamentals of Adaptive Signal Processing and related algorithms.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the non-linear control and the need and significance of changing the control parameters with respect to real-time situation.
2. Mathematically represent the 'adaptability requirement'.
3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

Unit 1: General concepts of Adaptive Signal Processing – General Aspects of adaptive filtering and estimation, applications and motivation, Review of probability, random

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variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit 2: Adaptive Signal Processing Algorithms - Optimal (Wiener) filter, Method of steepest descent, extension to complex valued, LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Unit 3: Signal space concepts - introduction to finite dimensional vectors pace theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram- Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces. Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit 4: Introduction to recursive least squares (RLS) - vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Recommended Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.
3. Alexander Thomas 1984/86.

BTEC-908D-18	Credits	L	T	P	Int	Ext
Soft Computing	3	3	0	0	40	60

Course Objectives

The main objective of this course is to enlighten the students with the basic fundamentals and concepts of Soft Computing and Algorithms.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the concepts of Soft Computing and Algorithms involved there-in
2. Understand Genetic Algorithms with its operators and applications
3. Learn about the Neural Network models and its applications
4. Describe the Fuzzy systems and Swarm Intelligence

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Unit 1: Introduction - What is soft computing? Differences between soft computing and hard computing, Soft Computing constituents, Methods in soft computing, Applications of Soft Computing. Introduction to Genetic Algorithms- Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators- methods of selection, crossover and mutation, simple GA(SGA), other types of GA, generation gap, steady state GA, Applications of GA

Unit 2: Neural Networks- Concept, biological neural system,. Evolution of neural network, McCullochPitts neuron model, activation functions, feed forward and feedback networks, learning rules – Hebbian, Delta, Perceptron learning and Windrow-Hoff,winner-take-all. Supervised learning- Perceptron learning, single layer/multilayer perceptron, Adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, Application of Neural networks in Image processing.

Unit 3: Fuzzy systems - Basic Definition and Terminology, Set-theoretic operations, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules & Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making; Neuro-fuzzy modeling- Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rule base Structure Identification.

Unit 4: Swarm Intelligence- What is swarm intelligence? Various animal behavior which have been used as examples, ant colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant-based routing, particle swarm optimization

Recommended Books:

1. S.N. Shivanandam, Principle of soft computing, Wiley. ISBN13: 9788126527410, 2011.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", PrenticeHall of India, 2003.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.
5. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
6. David E. Goldberg, Genetic Algorithms in Search, Optimization & Machine Learning, Addison Wesley, 1997.

BTEC-909A-18	Credits	L	T	P	Int	Ext
Big Data Fundamentals	3	3	0	0	40	60

Course Objectives

This course deals with knowledge of fundamentals, architecture and concepts for better understanding of Introduction of Big Data.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the Evolution and basics of Big Data.
2. Understand the Architecture of Hadoop with its file system and its Programming.
3. Explain the Advanced analytical theory and methods.
4. Describe the challenges in handling streaming data from the real world.

Unit 1 - Evolution & Introduction to Big data: Best Practices for Big data Analytics, Big data characteristics, Validating – The Promotion of the Value of Big Data, Big Data Use Cases, Characteristics of Big Data Applications, Perception and Quantification of Value, Understanding Big Data Storage.

Unit 2 - A General Overview of High Performance Architecture: HDFS, Map Reduce and YARN – Map Reduce Programming Model. Big Data Overview Analysis of data at Rest- Hadoop analytics: Limitations of existing distributing systems, Hadoop Approach, Hadoop Architecture, Distributed file system: HDFS and GPFS, Internals of Hadoop MR engine, Hadoop cluster components, Hadoop Ecosystem, Evaluation criteria for distributed Map Reduce runtimes, Enterprise-grade Hadoop Deployment, Hadoop Implementation

Unit 3 - Advanced Analytical Theory and Methods: Overview of Clustering – K-means, Use Cases, Overview of the Method, Determining the Number of Clusters, Clustering, Classification, Segmentation, Linear regression, ML Search: Indexing and Indexing Techniques, Create inverted index using JAQL, Data Explorer Bundling Hadoop job: Application, Diagnostics, Reasons to Choose and Cautions, Classification: Decision Trees, Overview of a Decision Tree, The General Algorithm – Decision Tree Algorithms, Evaluating a Decision Tree

Unit 4 - Real time analytics: Introduction to streams computing, Challenges/limitations of conventional Systems, Solving a real time analytics problem using conventional system, Challenges to be solved - scalability, thread pooling, etc., Understanding the challenges in handling streaming data from the real world and how to address those using stream computing, Benefits of stream computing in Big Data world, Realtime Analytics Platform (RTAP), Real Time Sentiment Analysis.

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Recommended Books:

1. Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, by Chris Eaton, Paul Zikopoulos, Wiley Publication 2015.
2. Big Data Analytics: Turning Big Data into Big Money By Frank J. Ohlhorst, McGraw Hill 2012.
3. Ethics of Big Data: Balancing Risk and Innovation By Kord Davis, 2011.
4. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends, By Michael Minelli, Michele Chambers, Ambiga Dhiraj, Wiley Publication 2013.

BTEC-908E-18	Credits	L	T	P	Int	Ext
Digital Image and Video Processing	3	3	0	0	40	60

Course Objectives

This course deals with the concept, knowledge and background required for better understanding of Digital Image and Video Processing.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding.

Unit 1: Digital Image Fundamentals - Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures. Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Unit 2: Color Image Processing - Color models–RGB, YUV, HSI; Color transformations– formulation, Color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation. Image Segmentation - Detection of discontinuities, edge linking and boundary detection, region-based segmentation. Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, Continuous wavelet transforms, Wavelet bases and multi-resolution analysis, Wavelets and Sub band filter banks, Wavelet packets. Image Compression-Redundancy–inter-pixel and psycho-visual; Still image compression standards – JPEG and JPEG-2000.

Unit 3: Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

Unit 4: Video Segmentation- Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

Recommended Books:

1.R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
2.Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004.
3. Murat Tekalp, Digital Video Processing" Prentice Hall, 2nd edition 2015.

Open Elective - 2

(The List of Open Electives (OE) courses offered is provided in the Study Scheme)

Open Elective - 3

(The List of Open Electives (OE) courses offered is provided in the Study Scheme)

Mandatory Courses

The syllabus of these courses is on the lines of AICTE Model Curriculum 2018

BTMC-101-18	Credits	L	T	P	Int	Ext
Indian Constitution	Non-credit	3	0	0	40	60

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America. The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does nottruly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1 Meaning of the constitution law and constitutionalism
2 Historical perspective of the Constitution of India
3 Salient features and characteristics of the Constitution of India
4 Scheme of the fundamental rights
5 The scheme of the Fundamental Duties and its legal status
6 The Directive Principles of State Policy–Its importance and implementation
7 Federal structure and distribution of legislative and financial powers between the Union and the States
8 Parliamentary Form of Government in India – The constitution powers and status of the President of India
9 Amendment of the Constitutional Powers and Procedure
10 The historical perspectives of the constitutional amendments in India
11 Emergency Provisions : National Emergency, President Rule, Financial Emergency
12 Local Self Government – Constitutional Scheme in India
13 Scheme of the Fundamental Right to Equality
14 Scheme of the Fundamental Right to certain Freedom under Article19
15 Scope of the Right to Life and Personal Liberty under Article21

Course Objectives: The objective of the course is to provide the basic knowledge about the Political System of the Country. The basic idea is to make the students aware of their duties and rights. Apart from it the course will aim to educate the pupils about the working of different organs of the government, various constitutional bodies and the agencies of the government. In addition to it, students will be given brief knowledge regarding the different challenges of Indian Political System, forms of Government in India and nature & dimensions of Indian Federal System. Course Pedagogy: Since the course is of Practical Importance, it is recommended that during the course students will be taken out for one visit to any place with the potential of imparting practical knowledge to the students about

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the Indian Political System. Such places can be Indian Parliament. State Legislative Assembly, Youth Parliament Pune. It is expected that students should be given case studies about the Indian Political System and Debates on Constitutional Issues should be organised in the campus.

Course Outcome: After the successful completion of the course students will be to understand the different dimensions of Indian Political System. They will be aware about their duties towards the fellow citizens. Students will be able to challenges of the democratic institutions and theoretical aspects of the state and its organs.

Suggested Reading:

1. Indian Political System by J C Johri
2. Indian Political System by Mahendra Prasad Singh
3. Fundamentals of Indian Political System by Rajesh K Jha.
4. Our Constitution by Subhash C Kashyap
5. Our Political System by Subhash C Kashyap
6. Indian Federalism – An Introduction by Mahendra Prasad Singh
7. Indian Federalism and Autonomy by S Chandrasekhar

BTMC-102-18	Credits	L	T	P	Int	Ext
Essence of Indian Traditional Knowledge	Non-credit	3	0	0	40	60

Part-1 Course objective

The course aims at imparting basis principals of thought process. Reasoning and inferencing Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit Literature are also important in modern society with rapid technological advancements and societal disruptions.

Part-1 focuses on introduction to Indian Knowledge System. Indian perspective of modern scientific world -view and basis principal of Yoga and holistic health care system.

Course Outcomes

-Ability to understand connect up and explain basics of Indian traditional Knowledge in Modern scientific perspective.
-Ability to understand connects up and explain basics of Indian traditional Knowledge in Modern scientific perspective.

Course contents

ii. Basic Structure of Indian Knowledge system
iii. ii. Modern Science and Indian Knowledge system
iv. Yoga and Holistic Health Care

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v. iv. Case studies

References

- Fritz of Capra Too of Physics
- Fritz of Capra The Wave of life
- Yoga Sutra of Patanjali. Ramakrishna Mission. Kolkata.
- RN Jha Science of Consciousness Psychotherapy and Yoga Practices. Vidyanidhi Prakashan. Delhi2016
- PB Sharma (English translation) Shodashang Hridayam

Pedagogy: Problem based learning, group discussion, collaborative mini projects

Part-2 Course objective

The course aims at imparting basis principals of thought process. Reasoning and inferencing Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit Literature are also important in modern society with rapid technological advancements and societal disruptions

Part-2 focuses on Indian philosophical traditions. Indian linguistic Tradition, and Indian artistic tradition.

Course contents

ii. Philosophical Tradition
iii. Indian Linguistic Tradition (Phonology, morphology, syntax and semantics)
iv. Indian Artistic Tradition
v. Case studies

References

- V.Sivaramakrishnan (Ed.), Cultural Heritage of India-Course material, Bhartiya Vaidya Bhawan Mumbai 5th Edition 2014
- S.C Chaterjee &D.M .Datta , An introduction to Indian Philosophy ,University of Calcutta 1984.
- KS Subrahmanialyer ,Vakyapadiya of Bhattaraihari (Brahma Kanda), Deccan College Pune 1965
- VN Jha, Language Thought and Reality
- Pramod Chandra. India Arts Howard Univ. Press 1983
- Krishna Chaitanya Arts of India. Abhinav Publications. 1987
- R Nagaswamy , Foundations of Indian Art Tamil Arts Academy.2002

Pedagogy: Problem based learning, group discussion, collaborative mini projects

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BTEC-731-18	Credits	L	T	P	Int	Ext
Project Stage - II	6	0	0	12	120	80

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up during Project-I, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Prototyping or Product development/Patent and Video demonstration;
6. Preparing a paper for Conference presentation/Publication in Journals;
7. Preparing a Dissertation in the standard format for being evaluated by the Department;
8. Final Seminar Presentation before a Departmental Committee.

BMPD-371-18	Credits	L	T	P	Int	Ext
Mentoring and Professional Development*	Non-credit	0	0	2	S/US**	

* As stated in the IKGPTU B.Tech 1st Year Scheme and Syllabus
**S/US - Satisfactory and Unsatisfactory

* Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

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Part – B

(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty in charges shall maintain proper record student wise of each activity conducted

and the same shall be submitted to the department.

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M. Tech ECE

(Wireless Communication)

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M.Tech. ECE (Wireless Communication) 2018 Study Scheme

Semester-1

Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
MTWC-101-18	Wireless Communication	3	0	0	40	60	100	3
MTWC-102-18	Information Theory & Coding	3	0	0	40	60	100	3
MTWC-PE1X-18	Elective I	3	0	0	40	60	100	3
MTWC-PE2Y-18	Elective II	3	0	0	40	60	100	3
MTWC-111-18	Wireless Communication Lab	0	0	4	60	40	100	2
MTWC-112-18	Information Theory & Coding Lab	0	0	4	60	40	100	2
MTRM-101-18*	Research Methodology & IPR	2	0	0	40	60	100	2
MTAXX-18	Audit Course I	2	0	0	S/US**	S/US**	100	Non-credit
	Total	**14**	**0**	**8**	**320**	**380**	**800**	**18**

Semester-2

Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
MTWC-103-18	Advanced Wireless Communication	3	0	0	40	60	100	3
MTWC-104-18	Soft Computing Techniques	3	0	0	40	60	100	3
MTWC-105-18	Simulation of Wireless Communication Systems	3	0	0	40	60	100	3
MTWC-PE3X-18	Elective III	3	0	0	40	60	100	3
MTWC-PE4Y-18	Elective IV	3	0	0	40	60	100	3
MTWC-113-18	Wireless Communication Simulation Lab	0	0	4	60	40	100	2
MTWC-MP1-18	Mini Project	0	0	4	60	40	100	2
MTAXX-18	Audit Course II	2	0	0	S/US**	S/US**	100	Non-credit
	Total	**17**	**0**	**8**	**320**	**380**	**800**	**19**

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Semester-3

Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
MTWC-PE5X-18	Elective V	3	0	0	40	60	100	3
MTOE-301X-18*	Open Elective	3	0	0	40	60	100	3
MTWC-DS1-18	Dissertation Phase I#	0	0	20	60	40	100	10
	Total	**6**	**0**	**20**	**140**	**160**	**300**	**16**

Semester-4

Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
MTWC-DS2-18	Dissertation Phase II#	6	0	20	60	40	100	16
	Total	**6**	**0**	**20**	**60**	**40**	**100**	**16**
					840	**960**	**2000**	**69**

* These courses are common to all M.Tech. Courses.

**S/US - Satisfactory/Unsatisfactory

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#The distribution of marks for evaluation of Dissertation Phase I and II shall be as under:

The following is the proposed composition of Departmental Research Committee (DRC) for M.Tech./ME evaluation and grading:

Head of Department (HOD)	Chairman
One faculty member as Department PG Coordinator (nominated by HOD)	Member
Supervisor(s)	Member(s)

Dissertation Phase I

(A) Internal Marks to be awarded by the Departmental Research Committee (DRC) for Dissertation Phase I:

1. Presentation-I (a. Subject Matter, b. Knowledge of Research Area, c. Literature Review, d. Response to Questions asked)	20
2. Presentation-II (a. Tentative Title, b. Objectives, c. Methodology, d. Problem Statement, d. Research Gap, e. Response to Questions asked)	20
3. Report	20
	60

(B) External Marks to be awarded by External Expert for Dissertation Phase I:
All members will award the remaining Forty (40) marks assigned to the viva-voce examination as per the following. HOD will approve the name of External Expert.

1. Presentation Structure	10
2. Response to Questions asked during presentation	10
3. Usefulness/Contribution of the work to the field	10
4. Evaluation of Report by External Expert	10
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Dissertation Phase II

(A) Internal Marks to be awarded by the Departmental Research Committee (DRC) for Dissertation Phase II:

1. Presentation-I (a. Final Title, b. Methodology (Simulation Tool(s), c. Performance evaluation regarding the implementation techniques, d. Response to Questions asked) 20
2. Presentation-II (a. Objectives achieved, b. Relevance of Research Work, c. Response to Questions asked) 20
3. M.Tech Dissertation (Plagiarism Check) 20

60

The HOD shall take the names of External Examiners (three senior faculty members) from the Supervisor and send the same to the Higher Authority as per University Norms.

(B) External Marks to be awarded by External Expert for Dissertation Phase II:
All members will award the remaining Forty (40) marks assigned to the viva-voce examination as per the following:

1. Presentation Structure (including M.Tech. Thesis) 10
2. Response to Questions asked during presentation 10
3. Usefulness/Contribution of the work to the field 10
4. Publication of paper(s) to Journal of repute 10

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Duties of DRC:

1. To Evaluate M.Tech Dissertation Phase-I and Phase-II.
2. To take approval from higher authority for External Expert.

Note: Decision of DRC will be final in all relevant cases.

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Study Scheme 2018 M.Tech. ECE (Wireless Communication)-Program Electives

Program Elective I	
MTWC-PE1A-18	Wireless Sensor Networks
MTWC-PE1B-18	RF MEMS for Wireless Communication
MTWC-PE1C-18	Advanced Digital Signal processing
MTWC-PE1D-18	Audio & Video Signal Processing
Program Elective II	
MTWC-PE2A-18	Advanced Communication Systems
MTWC-PE2B-18	Detection & Estimation Theory
MTWC-PE2C-18	Mobile Adhoc Networks
MTWC-PE2D-18	Optical Network and Photonic Switching
Program Elective III	
MTWC-PE3A-18	Smart Antennas
MTWC-PE3B-18	Wireless Network Planning, Optimization and Mnagement
MTWC-PE3C-18	Microwave and RF Design
MTWC-PE3D-18	Multimedia Communication and Technology
Program Elective IV	
MTWC-PE4A-18	Cryptography and Wireless Security
MTWC-PE4B-18	Software Defined Radio & Cognitive Radio
MTWC-PE4C-18	Wireless & Optical Communication Networks
MTWC-PE4D-18	MIMO Systems
Program Elective V	
MTWC-PE5A-18	Millimeter Wave Communication and Technology
MTWC-PE5B-18	Space Time Wireless Communication
MTWC-PE5C-18	Advance Techniques for Wireless Reception
MTWC-PE5D-18	Emerging Technologies in Wireless Communication
MTWC-PE5E-18	Microstrip Antennas

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Study Scheme 2018 M.Tech. ECE (Wireless Communication)

Audit Courses I and II & Open Electives

List of Audit Courses	
MTA101-18	English for Research Paper Writing
MTA102-18	Disaster Management
MTA103-18	Sanskrit for Technical Knowledge
MTA104-18	Value Education
MTA105-18	Constitution of India
MTA106-18	Pedagogy Studies
MTA107-18	Stress Management by Yoga
MTA108-18	Personality Development through Life Enlightenment Skills
Open Electives	
MTOE- 301A-18	Business Analytics
MTOE- 301B-18	Industrial Safety
MTOE- 301C-18	Operations Research
MTOE- 301D-18	Cost Management of Engineering Projects
MTOE- 301E-18	Composite Materials
MTOE- 301F-18	Waste to Energy

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First Semester

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MTWC-101-18 WIRELESS COMMUNICATION	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

To enable students understand the various aspects of wireless communication, factors affecting the communication link and physical models.

Course Outcomes

After the completion of the course, the student will be able to:

1. Implement physical models of wireless channels.
2. Gain knowledge of key concepts of wireless communication.
3. Measure capacity of AWGN channel, LTI Gaussian channels and various fading channels.
4. Study uplink and downlink model of AWGN channel, fading channels and multiuser diversity.

Unit I Physical modelling for wireless channels: Free space, fixed transmit and receive antennas, Free space, moving antenna, Reflecting wall, fixed antenna, Reflecting wall, moving antenna, Reflection from a ground plane, Power decay with distance and shadowing, Moving antenna, multiple reflectors

Unit II Input /output model of the wireless channel: The wireless channel as a linear time-varying system, Baseband equivalent model, discrete-time baseband model, Additive white noise

Unit III Time and frequency coherence: Doppler spread and coherence time, delay spread andcoherence bandwidth

Unit IV AWGN channel capacity: Repetition coding, Packing spheres, Capacity-achieving AWGNchannel codes, Reliable rate of communication and capacity, Resources of the AWGN channel-Continuous-time AWGN channel, Power and bandwidth, Bandwidth reuse in cellular systems

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Unit V Linear time-invariant Gaussian channels: Single input multiple output (SIMO) channel, Multiple input single output (MISO) channel, Frequency-selective channel

Unit VI Capacity of fading channels: Slow fading channel, Receive diversity, Transmit diversity, Transmit and receive diversity, Time and frequency diversity, Outage for parallel channels, Fast fading channel, Transmitter side information, Frequency-selective fading channels

Unit VII Uplink and Downlink AWGN channel: Capacity via successive interference cancellation, Comparison with conventional CDMA, Comparison with orthogonal multiple access, General K-use ruplink capacity, Symmetric case: two capacity achieving schemes, General case: superposition coding achieves capacity

Unit VIII Uplink and Downlink fading channel: Slow fading channel, Fast fading channel, Full channel side information, Channel side information at receiver only, Full channel side information, Frequency selective fading channels

Unit IX Multiuser diversity: Multiuser diversity gain, Multiuser versus classical diversity, Fair scheduling and multiuser diversity, Channel prediction and feedback, Opportunistic beam forming using dumb antennas, Multiuser diversity in multicell systems

Unit X Physical Modeling of MIMO channels: Line-of-sight SIMO channel, Line-of-sight MISO channel, Antenna arrays with only a line-of-sight path, Geographically separated antennas, Line-of-sight plus one reflected path, MIMO multipath channel, Angular domain representation of signals, Angular domain representation of MIMO channels, Statistical modeling in the angular domain, Degrees of freedom and diversity, Dependency on antenna spacing.

Recommended Books

- Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
- David Tse, Pramod Viswanath, Fundamentals of Wireless Communications, Cambridge

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MTWC-102-18 INFORMATION THEORY & CODING	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

To enable students to understand information signals, coding and compression techniques and error detection and correction handling.

Course Outcomes

After the completion of the course, the student will be able to:

1. Understand the fundamentals of information theory
2. Encode text, audio, speech, image and video signals through various coding and compression techniques.
3. Detect and correct errors in the received signals through error detecting and correcting codes

Unit I Information Theory: Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit.

Unit II Source Coding: Text, Audio And Speech: Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MPEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding

Unit III Source Coding: Image and Video: Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I, B, P frames, Motion estimation, Motion compensation, H.261, MPEG standard

Unit IV Error Control Coding: Block Codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes – Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC

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Unit V Error Control Coding: Convolutional Codes: Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding

Recommended Books

- R Bose, Information Theory, Coding and Crptography, TMH 2007
- Fred Halsall, Multidedia Communications: Applications, Networks, Protocols and Standards, Perason Education Asia, 2002
- K Sayood, Introduction to Data Compression, 3rd Edition, Elsevier 2006
- S Gravano, Introduction to Error Control Codes, Oxford University Press 2007
- Amitabha Bhattacharya, Digital Communication, TMH 2006

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PROGRAM ELECTIVES - I

MTWC-PE1-18 WIRELESS SENSOR NETWORKS	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

To enable students familiarize with sensor networks, its constraints and protocols.

Course Outcomes

After the completion of the course, the student will be able to:

1. Gain insights of Wireless Sensor Network(WSN) background, its challenges, constraints along with its advantages and applications.
2. Know the architecture of WSN and its sub-systems.
3. Explain node structure along with the technologies used in WSN.
4. Study various Wireless Propagation Models and discuss the various MAC protocols, communication protocols and routing protocols.

Unit I Introduction: Introduction to Wireless sensor networks, Definitions and background, Challenges and constraints, Single-sink single-hop WSN, Single-sink multi-hop WSN, Multi-sink multi-hop WSN, Advantages of sensor networks.

Unit II Applications of WSNs: Positioning and animals tracking, Entertainment, Logistics, Transportation, Industrial Control and Monitoring, Home Automation and Consumer Electronics, Security and Military Sensing, Asset Tracking and Supply Chain Management, Intelligent Agriculture and Environmental monitoring, Health Monitoring.

Unit III Node Structure: The Sensing Subsystem, Analog-to-Digital Converter, The Processor Subsystem, Architectural Overview, Microcontroller, Digital Signal Processor, Application-specific Integrated Circuit, Field Programmable Gate Array, Comparison Communication Interfaces, Serial Peripheral Interface, Inter-Integrated Circuit, Prototypes, The IMote Node Architecture, The XYZ Node Architecture, The Hogthrob Node Architecture

Unit IV Technologies for WSNs: ZigBee technology, Ultrawide bandwidth technology, Bluetooth technology, Comparison among technologies

Unit V

Physical Layer: Introduction, Wireless Propagation Models: The Free Space Propagation Model, The Two-Ray Ground Model, The Log-Distance Path Model, Energy Dissipation Model, Error Models: The Independent Error Model, The Two-State Markov Error Model, Sensing Models: The Binary Sensing Model, The Probabilistic Sensing Model

Unit VI Communication Protocols for WSNs: MAC protocols: Scheduled protocols, LEACH protocol, Guo protocol, TRAMA protocol, Contention-based protocols, Zhong protocol, DMAC protocol, PAMAS protocol, SMAC protocol.

Unit VII Routing Protocols: Issues in designing routing protocols, Classification of routing protocols, Flat routing, Flooding and gossiping, SPIN protocol, Directed diffusion protocol, Rumour routing, Gradient-based routing, Hierarchical routing, LEACH protocol, PEGASIS protocol, TEEN protocol, MECN protocol, SPAN protocol, Location-based routing protocols, GAF protocol, GEAR protocol, GeRaF protocol, Rugin protocol.

Recommended Books

- Kazem Sohraby, Daniel Minoli, TaiebZnati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley Inter Science
- Edgar H. Callaway, Wireless Sensor Networks: Architectures and Protocols, Jr. AuerbachPublications, CRC Press
- C. S Raghavendra, Krishna M, Sivalingam, TaiebZnati, Wireless Sensor Networks, Springer
- Bhaskar Krismachari, Networking Wireless Sensors, Cambridge University Press
- Victor Lesser, Charles L. Ortiz, Milind Tambe, Distributed Sensor Networks: A MultiagentPerspective, Kluwer Publications

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- Feng Zhao, Leonidas Guibas, Wireless Sensor Networks: An Information Processing Approach,Morgan Kaufmann Series in Networking 2004
- Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: TheoryAnd Practice, John Wiley & Sons, August 2010

MTWC-PE1B-18	Credits	L	T	P	Internal	External
RF MEMS FOR WIRELESS COMMUNICATION SYSTEM	3	3	0	0	40	60

Course Objective

To familiarize students with circuits and circuit elements used in radio frequency MEMS wireless communication system.

Course Outcomes

After the completion of the course, the student will be able to:

1. Understand the key concepts in RF based MEMS wireless communication system
2. Design RF based circuits through modelling
3. Understand the usage of RF based circuit elements to reconfigure the circuit design
4. Study various oscillators and filters

Unit I Introduction: Spheres of wireless activities, the home and office, the ground fixed/mobile platform, the space platform, wireless standards, systems and architectures, wireless standards, conceptual wireless systems, wireless transceiver architectures, power and bandwidth-efficient wireless systems & challenges, MEMS based wireless appliances enable ubiquitous connectivity. Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self resonance frequency, quality factor packaging, practical aspects of RF circuit design, dc biasing, impedance mismatch effects in RF MEMS.

Unit II Enabled Circuit Elements: RF/Microwave substrate properties, Micro machined – enhanced

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elements – capacitors, inductors, varactors, MEM switches – shunt MEM switch, low voltage hinged MEM switch approaches, push-pull series switch, folded – beam – springs suspension series switch.

Unit III Resonators & Enabled Circuits: transmission line planar resonators, cavity resonators, micromechanical resonators, film bulk acoustic wave resonators, MEMS modeling – mechanical modeling, electromagnetic modeling. Enabled circuits – reconfigurable circuits – the resonant MEMS switch, Capacitors, inductors, tunable CPW resonator, MEMS microswitch arrays.

Unit IV Reconfigurable Circuits: Double – stud tuner, Nth – stub tuner, filters, resonator tuning system, massively parallel switchable RF front ends, true time-delay digital phase shifters, Reconfigurable antennas – tunable dipole antennas, tunable microstrip patch-array antenna. Phase shifters fundamentals, X-Band RF MEMS Phase shifter for phased array applications, Ka-Band RF MEMS Phase shifter for radar systems applications.

Unit V Filters & Oscillators: Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications, RF MEMS filters – A Ka-Band millimeter-wave Micromachined tunable filter, A High-Q8-MHz MEM Resonator filter, RF MEMS Oscillators – fundamentals, A 14-GHzMEM Oscillator, A Ka-Band Micromachined cavity oscillator, A 2.4 GHz MEMS based voltage controlled oscillator.

Recommended Books

- Hector J. De Los Santos, RF MEMS Circuit Design for Wireless Communications, Artech House,2002
- Vijay K. Varadan, K. J. Vinoy, K. A. Jose., RF MEMS and their Applications, John Wiley and sons, Ltd., 2002
- Gabriel M. Rebeiz, RF MEMS Theory, Design & Technology, Wiley Interscience, 2002

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MTWC-PE1C-18 ADVANCED DIGITAL SIGNAL PROCESSING	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

To understand the importance and usage of different signals, digital systems and processors.

Course Outcomes

After the completion of the course, the student will be able to:

1. Apply digital transform techniques on signals
2. Design digital FIR and IIR filters
3. Predict and estimate errors in digital signal processing systems
4. Handle multirate DSP and use adaptive filters

Unit I Review: Fourier Transforms, Z-Transforms, Discrete Fourier Transform, Fast Fourier Transform, Convolution and Correlation.

Unit II Design of digital filters: Introduction to filter design, types of digital filters,choosing between, FIR and IIR filters, filter design steps, effect of finite register length in filter design, realization of IIR digital filters and fir digital filter, design of IIR filters from continuous time filters, design of FIR filters by windowing.

Unit III Digital signal processors: General and special purpose digital signal processors, computerarchitecture for signal processing, selecting digital signal processors, architecture and programming of ADSP 2181 processor.

Unit IV Spectrum estimation: non-parametric methods correlation method, co-variance estimator,performance analysis of estimators, consistent estimators, AR, MA, ARMA signal modeling parameter estimation using Yule-walker method.

Unit V Linear estimation and predication: Maximum likelihood criterion efficiency of estimator,leastmean squared error criterion, recursive estimators, and linear predications.

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Unit VI Multirate digital signal processing: Mathematical description of change of sampling rate,interpolation and decimation, continuous time model, direct digital domain approach, interpolation anddecimation by an integer factor, single and multistage realization, applications of sub band coding.

Unit VII Adaptive Filters: Applications of Adaptive Filters, Adaptive Direct Form FIR Filters: The LMS Algorithm, Adaptive Lattice Ladder Filters, Recursive Least Squares Lattice Ladder Algorithms.

Recommended Books

- Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, NewYork, 1996
- Emmanuel C. Ifeachor Barrie W. Jervis, Digital Signal Processing, Pearson Education, Asia
- ProakesManolakis, Digital Signal Processing principles, algorithms, and applications, Prentice HallIndia
- ADSP 2181 manuals
- Keshab K. Parhi, VLSI DSP Systems; Design & implementation, Wiley Inter Science Publishers
- Moonen, Ian k. Proudler, Algorithms for statistic

MTWC-PE1D-18	Credits	L	T	P	Internal	External
AUDIO AND VIDEO SIGNAL PROCESSING	3	3	0	0	40	60

Course Objective

To inculcate in students the knowledge of audio and video signal generation, transmission, processing and reception.

Course Outcomes

After the completion of the course, the student will be able to:

1. Learn the audio and video signal processing systems.

2. Code and decode the image, audio and video signals.
3. Modulate and demodulate digital signal processing systems.

Unit I: Limitation of natural reverberation by electronic devices, circuit solutions of Schroederre verberators based on DSP. Systems of audio signal processing for home theatres 3D sound, DolbyProLogic, Dolby Digital, DTS, THX, coding and decoding of audio signals.

Unit II: Systems of synthesis of natural and unnatural sounds, sound paradoxes. Properties, algorithms of computation, application of wavelet transform and wavelet systems to separate noise and undesirable components of audio signals and video signals. Methods a algorithms of preprocessing and postprocessing of images in spatial and frequency domain with application of discrete orthogonal 2Dtransformations.

Unit III: Modern methods of digital coding of images and video sequences entropic, predictive, transform, hybrid, hierarchical, sub band, wavelet. Intra frame and predictive interframe source coding of video sequences with movement estimation. Nonlinear and invariant transforms in applications of image processing and coding and movement estimation in video sequences.

Unit IV: International standardized codecs in systems DVB T,C,S a DVB H for mobile communication systems 31/2 a 4G. Methods of channel coding and decoding of digital video signals, digital modulations and demodulations in systems DVB T,C,S,H.

Recommended Books

- Branderburg K., Kahrs M., Applications of Digital Signal Processing to Audio and Acoustics, New York, Kluwer Academic Publishers, 2002
- Russ, M., Sound Synthesis and Sampling, Amsterdam, Focal Press, 2004
- Vaseghi S., Multimedia Signal Processing - Theory and Applications in Speech, Music and Communications, Chichester, England, John Wiley & Sons, 2007
- Zözler U., Digital Audio Signal Processing, Chichester, England, John Wiley & Sons, 2008
- Park T., Introduction to Digital Signal Processing Computer Musically Speaking, New Jersey, World Scientific Publishing Co., 2010.

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PROGRAM ELECTIVES - II

MTWC-PE2A-18	Credits	L	T	P	Internal	External
ADVANCED COMMUNICATION SYSTEM	3	3	0	0	40	60

Course Objective

To familiarize with the working of advanced communication systems.

Course Outcomes

After the completion of the course, the student will be able to:

1. Differentiate between analog and digital communication systems.
2. Transmit data through various digital modulation techniques.
3. Understand optical and satellite communication systems.
4. Recognize mobile communication systems, access techniques and transmission protocols.

UNIT-I Introduction: Conceptualized model of Digital Communication System (Description of different modules of the block diagram), Complex baseband representation of signals, Gram-Schmidt Orthogonalization procedure. Geometric Interpretation of Signals, Response of Bank of Correlators to Noisy Input, M-ary orthogonal signals, Complex Signal space and Orthogonality, Energy of the Sum of Orthogonal Signals

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UNIT-II Band-limited channels: Pulse shaping for channels with ISI: Nyquist's First Criterion for Zero ISI, Partial response signaling (Duobinary and modified Duobinary pulses), detection of Duobinary Signaling, Maximum likelihood estimation technique.

UNIT-III Performance Analysis of Digital Communication Systems: Optimum Linear Detector for Binary Polar Signaling-Binary Threshold detection, Optimum Receiver Matched Filter, General Binary Signaling, Performance analysis of General Binary systems, Coherent Receivers for Digital Carrier Modulations, Signal Space Analysis of Optimum Detection, Vector Decomposition of White Noise Random Processes, Optimum Receiver for White Gaussian Noise Channels, Generalized Expression for Error Probability of Optimum Receivers.

UNIT-IV 4G Technology /OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, BER performance over AWGN and Rayleigh fading, OFDM Issues like PAPR, Frequency and Timing Offset.

Recommended Books:

1. G. Proakis and M. Salehi, 'Fundamentals of Communication Systems', Pearson Education, 2005.
2. S. Haykins, 'Communication Systems', 5th Edn., John Wiley, 2008.
3. B.P.Lathi and Zhi Ding, 'Modern Digital and Analog Communication Systems, International Fourth Edition, Oxford University Press 2010.
4. S.Haykin, 'Digital Communication' Wiley-India, 2010

MTWC-PE2B-18	Credits	L	T	P	Internal	External
DETECTION AND ESTIMATION THEORY	3	3	0	0	40	60

Course Objective

To understand the different detection and estimation techniques for different signals.

Course Outcomes

After the completion of the course, the student will be able to:

1. Know the background of the signals, variables and processes.

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2. Test the data through statistical tools.
3. Learn the ways to detect non-parametric, random and deterministic signals.
4. Familiarize with the estimation of signal parameters

Unit I Background: Review of Gaussian variables and processes; problem formulation and objective ofsignal detection and signal parameter estimation in discrete-time domain.

Unit II Statistical Decision Theory: Bayesian, minimax, and Neyman-Pearson decision rules, likelihoodratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

Unit III Detection of Deterministic Signals: Matched filter detector and its performance; generalizedmatched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model.

Unit IV Detection of Random Signals: Estimator-correlator, linear model, general Gaussian detection,detection of Gaussian random signal with unknown parameters, weak signal detection.

Unit V Nonparametric Detection: Detection in the absence of complete statistical description ofobservations, sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors.

Unit VI Estimation of Signal Parameters: Minimum variance unbiased estimation, Fisher informationmatrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

Unit VII Signal Estimation in Discrete-Time: Linear Bayesian estimation, Weiner filtering, dynamicalsignal model, discrete Kalman filtering.

Recommended Books

- H. L. Van Trees, Detection, Estimation and Modulation Theory: Part I, II, and III, John Wiley, NY, 1968

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- H. V. Poor, An Introduction to Signal Detection and Estimation, Springer, 2nd Edition, 1998
- S. M. Kay, Fundamentals of Statistical Signal Processing: Estimation Theory, Prentice Hall PTR, 1993

MTWC-PE2C-18	Credits	L	T	P	Internal	External
MOBILE ADHOC NETWORKS	3	3	0	0	40	60

Course Objective

To understand the working and protocol stack in mobile adhoc network.

Course Outcomes

After the completion of the course, the student will be able to:

1. Know the features, applications, models and characteristics of adhoc networks.
2. Learn the protocols followed in MAC layer, Network layer, Transport layer, Security layer and Cross layer design.
3. Learn how to integrate adhoc networks with mobile-IP networks.

Unit I Introduction: Introduction to adhoc networks–definition, characteristics features, applications,Characteristics of Wireless channel, Adhoc Mobility Models:- Indoor and outdoor models.

Unit II Medium Access Protocols MAC Protocols: design issues, goals and classification. Contentionbased protocols-with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

Unit III Network Protocols: Routing Protocols: Design issues, goals and classification. Proactive Vsreactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

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Unit IV End-End Delivery and Security: Transport layer: Issues in desiging- Transport layerclassification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

Unit V Cross Layer Design and Integration of Adhocfor 4G: Cross layer Design: Need for crosslayer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary prespective. Intergration of adhoc with Mobile IP networks.

Recommended Books

- C. Siva Ram Murthy, B. S. Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd Edition, Pearson Education, 2007
- Charles E. Perkins, Ad hoc Networking, Addison, Wesley, 2000
- Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic, Mobile Adhoc Networking, Wiley-IEEE Press, 2004
- Mohammad Ilyas, The handbook of Adhoc Wireless Networks, CRC press, 2002

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MTWC-PE2D-18	Credits	L	T	P	Internal	External
OPTICAL NETWORK AND PHOTONIC SWITCHING	3	3	0	0	40	60

Course Objective

To understand the communication process in optical networks and switching process.

Course Outcomes

After the completion of the course, the student will be able to:

1. Know the optical transmission and reception.
2. Apply the compensation techniques to the lost data/signals.
3. Learn the architecture and protocols of passive optical networks.
4. Learn the process of wire line techniques.

UNIT I Ray Theory Analysis & Transmission Characteristics: Fibre Optic Guides, Light wavegeneration systems, systems components, optical fibers, SI, GI fibre, modes, Dispersion in fibers limitations due to dispersions, fibre loss, non liner effects.

UNIT II Optical Transmitters & Receivers: Optical Transmitters and Fibres, Basic concept, spectraldistribution, semiconductor lasers, gain coefficients, modes. Transmitter design, Receive PIN and APD diodes,SNR. Switches, Coherent, homodyne and Hetro dyne keying formats, BER in synchronous and Asynchronous.

UNIT III Compensation Techniques: Amplifiers, Basic concepts, Semiconductor laser amplifiers Ramanand Brillouin-fibre amplifiers, Erbium doped-fibre and amplifiers, pumping phenomenon Dispersion Compensation Limitations, post and pre-compensation techniques, equalizing filters, SONET/SDH.

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UNIT IV Passive Optical Networks: Architectures And Protocols: PON Architectures,NetworkDimensioning and operation, Power Budget, FTTx , Broadband PON: architecture, protocol and Service, Bandwidth allocation. Gigabit-Capable PON. Burst switching, Ethernet PON Architecture, 10GEPON PMD Architecture.

UNIT V Wire Line Techniques: Wire line Narrowband, XDSL, Wire line broad band, Very High Bit RateDigital Subscriber Line (VDSL), Cable MODEM Home Networks, & VDSL Transmission Protocols. DOCSIS-Standards.

Recommended Books

- G. Keiser, Optical Communications Essentials, 1st Reprint, Tata McGraw Hill, 2008
- G. Keiser, Optical Fibre Communication System, McGraw Hill, New York, 2000
- J. M. Pitts & J. A. Schormans, Introduction to IP and ATM Design and Performance, 2nd Edition, Wiley, 2000
- G. P. Agarwal, Fibre Optic Communication System, 2nd Edition, John Wiley & b sons, New York 1997
- Franz, Jain, Optical Communication System, Narosa Publications, New Delhi, 1995
- Leonid G. Kazovsky, Ning Cheng, Wei-Tao Shaw, David Gutierrez, Shing-Wa Wong, BroadbandOptical Access Networks, John Wiley and Sons, New Jersey, 2011

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MTWC-111-18	Credits	L	T	P	Internal	External
WIRELESS COMMUNICATION LAB	2	0	0	4	40	60

Course Objective

This Laboratory will help the PG students to understand and design/Investigate Wireless channels, Fading environment and analyze their behavior.

Course Outcomes

1. To design Path-Loss models
2. To realize fading environments in wireless channels
3. To realize general modulation techniques

List of Experiments

1. Design Free-Space Propagation-Path Loss model to determine the free space loss and power received.
2. Realization of WLAN Multipath Channel to plot BER-SNR and Bit Rate -SNR graph for the fading environments of (i) No Fading (ii) Flat Fading
3. Realization of WLAN Multipath Channel to plot BER-SNR and Bit Rate -SNR graph for Dispersive Fading environment.
4. Implement Amplitude Modulation Techniques
5. Realize Frequency Modulation and Pulse Modulation.
6. Study the behavior of different filters.
7. Simulate MIMO channel and estimate BER and SNR .

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MTWC-112-18	Credits	L	T	P	Internal	External
INFORMATION THEORY & CODING LAB	2	0	0	4	40	60

Course Objective

This Laboratory will help the PG students to understand and learn to implement programs for Information Theory and Coding.

Course Outcomes

1. To understand the programming of Entropies and Mutual Information
2. To learn and practice programming for generation and evaluation of various codes
3. To develop MATLAB codes for Block codes, Cyclic codes and Convolutional codes.

List of Experiments

1. Write a program for determination of various entropies and mutual information of a given channel.

2. Write a program for generation and evaluation of variable length source coding using C/MATLAB
a) Shannon – Fano coding and decoding
b) Huffman Coding and decoding
c) Lempel Ziv Coding and decoding

3. Write a Program for coding & decoding of Linear block codes.

4. Write a Program for coding & decoding of Cyclic codes.

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5. Write a program for coding and decoding of convolutional codes.

6. Write a program for coding and decoding of BCH and RS codes.

7. Write a simulation program to implement source coding and channel coding for transmitting a text file.
More programs can be added as per the syllabus.

MTRM-101-18 RESEARCH METHODOLOGY & IPR	Credits	L	T	P	Internal	External
	2	2	0	0	40	60

Course Objective

To enable student to acquire knowledge of research process: gather data, implement the proposed work and collect the results and publish them.

Course Outcomes

After the completion of the course, students will be able to

1. Understand research, research process, define and redefine research problem through literature survey.
2. Know the primary and secondary sources of data collection and select sample size based on the requirement.
3. Utilize the resources efficiently.
4. Critically analyze the data through various statistical measures, perform experiment, gather data and reach to a conclusion based on some hypothesis.
5. Know the intellectual property rights.
6. Write up the report and research article.

Unit I Overview of Research: Meaning of Research, Objectives of research, Types of research, Research approaches, Significance of research, Criteria of good research. Defining the research problem: research problem, Necessity of defining the problem, Technique involve in defining a problem.

Unit II Research Design: Need for research design, Features of a good design, Basic principles of Experimental design Data Collection: Methods of Data Collection; Primary data and Secondary Data.

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Unit III Data preparation: Data preparation process, designing questionnaires and schedules. Descriptive statistics: Measures of central tendency, Mean,Median, Mode etc. Sampling and non-sampling errors, Testing of Hypotheses: Parametric (t, z and F) Chi Square, ANOVA, and non-parametric tests.

Unit IV Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), Patents, Patent Law, Copyright, Trademarks, Geographical Indications, Industrial Design, Unfair Competition, Protection of IPR, Basic steps to write a research paper/ report writing, Introduction to Latex report writing, Introduction to Plagiarism.

Suggested Readings/ Books:

- Krishnaswami K. N., Sivakumar A. I., Mathirajan M., *Management Research Methodology*, Pearson Education, New Delhi
- Kothari C. R., Research Methodology Methods and Techniques, 2nd Edition, New Age International Publishers
- Halbert, Resisting Intellectual Property, Taylor & Francis Ltd ,2007.
- Niebel, Product Design, McGraw Hill.
- Asimov, Introduction to Design, Prentice Hall.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, Intellectual Property in New Technological Age.
- T. Ramappa, Intellectual Property Rights Under WT, S. Chand
- J.F.Kaiser, "Richard Hamming-You and Your Research", Transcription of Bell Communications Research Colloquium Seminar, 1986.

MTA101-18 Audit Courses -I

MTA1O1-18						
Audit Course 1	Credits	L	T	P	Internal	External
English for research paper writing	Non-credit	0	0	0	S/US	S/US

Course Objective

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This course is to develop skills in effective English writing to communicate the research work

Course Outcomes

At the end of this course Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Ensure the good quality of paper at very first-time submission

Unit 1

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit 5

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit 6

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Recommended Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

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2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

MTA102-18						
Audit Course 1 **Disaster Management**	Credits	L	T	P	Internal	External
	Non-credit	0	0	0	S/US	S/US

Course Objective

This course is to develop skills in helping society during natural disasters and how to manage.

Course Outcomes

At the end of this course students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Unit 1

Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit 2

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Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Unit 4

Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 5

Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit 6

Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Recommended Books :

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep & Deep Publication Pvt. Ltd., New Delhi.

MTA103-18	Credits	L	T	P	Internal	External
Audit Course 1 **Sanskrit For Technical Knowledge**	Non-credit	0	0	0	S/US	S/US

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Course Objective

This course is to develop

1. A working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes

At the end of this course students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

Unit 1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit 2

Order, Introduction of roots, Technical information about Sanskrit Literature.

Unit 3

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Recommended Books:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

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MTA104-18 Audit Course 1 Value Education	Credits	L	T	P	Internal	External
	Non-credit	0	0	0	S/US	S/US

Course Objective

This course is to develop

1. Value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Course Outcomes

At the end of this course students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgements.

Unit 2

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence,Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline.

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Unit 3

Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

Unit 4

Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.

Recommended Books:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

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Second Semester

MTWC-103-18 ADVANCED WIRELESS COMMUNICATION	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

To learn the fundamentals and advanced concepts in wireless communication.

Course Outcomes

After the completion of the course, the student will be able to:

1. Review the fundamentals of wireless communication.
2. Compare the performance of different digital modulation techniques over wireless channels.
3. Design OFDM system and data transmission through multicarrier modulation.
4. Describe OFDMA system, its operation and applications.

Unit I Review of Fundamentals of Wireless Communication: Multipath fading, multipath channel models, and capacity of wireless channels.

Unit II Performances of Digital Modulation over Wireless Channels: AGWN channels signal to noise power ratio and bit/symbol energy, error probability for BPSK, QPSK, MPSK, MPAM, MQAM- their comparison.

Unit III Multicarrier Modulation: Data transmission using multiple carriers, multicarrier modulation with overlapping sub channels, mitigation of subcarrier fading, discrete implementation of multicarrier modulation, challenges in multicarrier systems.

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Unit IV Introduction to Wireless OFDM: OFDM principles, system model, generation of sub carrier using IFFT, guard time, cyclic extension, windowing, OFDM parameters, OFDM signal processing, coherent and differential detection

Unit V OFDMA: frequency hopping in OFDMA, difference between OFDMA and MC-CDMA, OFDMAsystem description-channel coding, frequency synchronization, initial modulation timing and frequency offset synchronization accuracy, random frequency hopping operation, applications of OFDMA.

Recommended Books

- Goldsmith, Wireless Communications, Cambridge Univ. Press, 2005
- R. Vannee, R. Prasad, OFDM for Wireless Multimedia Communication, Artech House, 2000
- M. Engels, Wireless OFDM systems, Klumer Academic Publishers, 2002

MTWC-104-18	Credits	L	T	P	Internal	External
SOFT COMPUTING TECHNIQUES	3	3	0	0	40	60

Course Objective

To enable the students utilize the soft computing techniques to optimize the systems.

Course Outcomes

After the completion of the course, the student will be able to:

1. Study basic concept of soft computing and differentiate between supervised, unsupervised and reinforced learning methods.
2. Learn various artificial neural network techniques, fuzzy sets, fuzzification and defuzzification.
3. Optimize solutions using Genetic Algorithm.

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4. Use hybrid soft computing techniques.

Unit I Artificial Neural Network: Basic concept of Soft Computing; Basic concept of neural networks, Mathematical model, Properties of neural network, Typical architectures: single layer, multilayer, competitive layer; Different learning methods: Supervised, Unsupervised & reinforced; Common activation functions; Feed forward, Feedback & recurrent N.N; Application of N.N; Neuron. Pattern Recognition: Pattern Classification, Pattern Association, Clustering, Simple Clustering algorithm, k-means & k-medoid based algorithm. Models Of Neural Network: Architecture, Algorithm & Application of McCulloh-Pitts, Hebb Net, Perceptron (with limitations & Perceptron learning rule Convergence theorem), Back propagation NN, ADALINE, MADALINE, Discrete Hopfield net, BAM, Maxnet , Kohonen Self Organizing Maps, ART1, ART2.

Unit II Fuzzy Sets & Logic: Fuzzy versus Crisp; Fuzzy sets—membership function, linguistic variable,basic operators, properties; Fuzzy relations—Cartesian product, Operations on relations; Crisp logic— Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic— Quantifiers, Inference; Fuzzy Rule based system; Defuzzification methods; FAM

Unit III Genetic Algorithm: Basic concept; role of GA in optimization, Fitness function, Selection of initialpopulation, Cross over(different types), Mutation, Inversion, Deletion, Constraints Handling; Evolutionary Computation; Genetic Programming; Schema theorem; Multi objective & Multimodal optimization in GA; Application—Travelling Salesman Problem

Unit IV Hybrid soft computing Techniques: GA based BPNN(Weight determination, Application);Neuro Fuzzy Systems—Fuzzy BPNN--fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G. A.

Recommended Books

- S. N. Sivanandam,S.N. Deepa, Principles of Soft Computing, Wiley India
- Simon Haykin, Neural Networks- A Comprehensive foundation, 2nd Edition Pearson

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- T. S. Rajasekaran, G. A. Vijaylakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms–Synthesis & applications, PHI
- Sanchez, Takanori, Zadeh, Genetic Algorithm & fuzzy Logic Systems, World Scientific
- Goldberg David E., Genetic Algorithm, Pearson
- Zimmermann H. J., Fuzzy Set Theory & Its Applications, Allied Publishers

MTWC-105-18	Credits	L	T	P	Internal	External
SIMULATION OF WIRELESS COMM. SYSTEMS	3	3	0	0	40	60

Course Objective

To inculcate in students the knowledge of simulation of real time wireless communication systems.

Course Outcomes

After the completion of the course, the student will be able to:

1. Study the role of simulation in communication system and random processes.
2. Review stochastic processes and parameter estimation.
3. Model wireless communication systems through numerical methods.
4. Study communication channel models and perform Monte Carlo Simulation.

Unit I Introduction to simulation approach: Methods of performance evaluation-simulation approach-Advantages and limitations. System model steps and its types involved in simulation study. Error sources in simulation. Role of simulation in communication system and random process. Introduction to random variables - univariate models (discrete and continuous) and multi-variate models.

Unit II Review of Stochastic process and parameter estimation: Stochastic process: Definitions,properties – stationarity, time averaging and ergodicity, random process models. Parameter estimation: Quality of an estimator, estimating average power probability density function, estimation of power spectral density of a process, delay and phase. SNR estimation and importance sampling.

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Unit III Numerical methods for wireless Communication Systems: numerical differentiation,integration, differential equation.

Unit IV Monte Carlo simulation: concepts and integration, Application in wireless CommunicationSystems.

Unit V Modelling of Communication systems: properties, generation and techniques for generatingrandom numbers and processes. Introduction to modeling of communication systems - Information sources, source coding, base band modulation, channel coding, RF and optical modulation, filtering, multiplexing, detection/demodulation- carrier and timing recovery for BPSK and QPSK. Modeling considerations for PLL.

Unit VI Communication channel models

Statistical characterization of multipath channels and time-varying channels with Doppler effects, models for multipath fading channels. Finite state channel models – channels with and without memory. Methodology for simulating communication systems operating over fading channels.

Recommended Books

- M. C. Jeruchim, Philip Balaban, K. Sam shanmugam, Simulation of communication systems, Plenum Press, New York, 1992
- M. Law, W. David Kelton, Simulation Modelling and analysis, McGraw Hill, New York, 1999
- K. Hayes, Modelling and Analysis of computer communication networks, Plenum press, New York, 1984
- Banks, J. S. Carson, Nelson, D. M. Nicol, Discrete–Event system simulation, Prentice Hall of India, 4th Edition, 2005
- Z. Peebles , Probability, Random Variable and Random Signal Principles, Tata McGraw Hill, 4th Edition 2007

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MTWC-105-18 WIRELESS COMMUNICATION SIMULATION LAB	Credits	L	T	P	Internal	External
	2	0	0	4	40	60

Course Objective

This Laboratory will help the PG students to understand and learn to implement programs related to Simulation of Wireless Communication.

Course Outcomes

1. To understand the programming of OFDM based Transmitter & Receiver.
2. To learn and practice MATLAB programming for implementing Digital modulation techniques.
3. To find the vacant spaces for secondary users in Cognitive Radio Networks..

List of experiments:

1. Develop MATLAB code to design OFDM based transmitter and receiver for different channel environment conditions.
2. Estimate and analyze the lifetime of 100 nodes in WSN using LEACH Protocol.
3. Develop MATLAB codes to Implement Digital Modulation techniques (i)ASK (ii) FSK (iii) M-PSK (iv) M-QAM (v)PCM.
4. Find the vacant spaces for Secondary Users in Cognitive Radio Network using Spectrum Sensing Techniques (i)Energy detection (ii)Matched Filter detection (iii) Cylostationary Detection.
5. Design OFDM System with 2x2, 2x4 and 4x4 MIMO System.

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MTWC-MP1-18	Credits	L	T	P	Internal	External
MINI PROJECT	2	0	0	4	40	60

Course Objective

To implement the knowledge gained during course practically.

Course Outcomes

After the completion of the course, the student will be able to:

1. Acquire practical knowledge of the chosen field.
2. Identify, analyze, formulate & handle programming projects with systematic approach.
3. Contribute as a team leader in the development of technical projects.
4. Develop communication skills for the presentation of project related activities.

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PROGRAM ELECTIVES - III

MTWC-PE3A-18 Smart Antennas	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This Elective course is meant to recall the important concepts of Smart Antennas, their significance, applications and understand the behavior and working of Smart antennas with the help of the beam forming and other techniques.

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand the significance of smart antennas and its historical development.
2. Know the architecture of Smart antennas, types, applications
3. Learn antenna array fundamentals criteria and beam forming basics.
4. Explain the Spatial Processing techniques for CDMA Smart Antennas.

Unit I Introduction to Smart Antennas: Why smart antennas, benefits of smart antennas, spatial processing for wireless systems, wideband smart antennas, historical development

Unit II Antenna Fundamentals: Antenna field regions, power density, radiation intensity, antenna nomenclature, friis transmission formula, linear antennas, loop antennas.

Unit III Array Fundamentals: Linear arrays, array weighting, circular arrays, rectangular arrays, fixed beam and retrodirective arrays.

Unit IV Beam Forming Basics: Maximum signal to interference ratio, minimum mean square ratio, minimum variance, adaptive beamforming, description of new SDMA receiver, software radios for smart antennas.

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Unit V Smart Antenna Techniques for CDMA: Non-coherent CDMA spatial processors, coherent CDMA spatial processors and the spatial processing rake receiver, multi-user spatial processing, dynamic re-sectoring using smart antennas, downlink beam forming for CDMA.

Recommended Books

- Gross F. B., Smart Antennas for Wireless Communications with MATLAB, McGraw-Hill, New York, 2005.
- Balanis A., Antenna Theory Analysis and Design, John Wiley and Sons, New York, 1982
- Joseph C. Liberti, Theodore S. Rappaport, Smart Antennas for Wireless Communications: IS95 and third generation CDMA Applications, Prentice Hall Communications Engineering and Emerging Technologies Series

MTWC-PE3B-18 Wireless Network Planning, Optimization and Management	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This Elective course is meant to recall the important fundamentals of Wireless Network Planning, its significance, applications and understand their optimization and management.

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand the Radio Network planning and optimization.
2. Know the technologies of WCDMA and GSM
3. Learn the fundamentals of Radio Resource Management

Unit I Introduction to Radio Network Planning and Optimisation - Future Trends -Towards a Service-driven Network Management - Wireless Local Area Networks (WLANs) - Next-generation Mobile Communication

Unit II WCDMA Radio Network Planning: WCDMA Radio Network Planning: Dimensioning - Detailed Planning - Verification of Dimensioning with Static Simulations - Verification of Static Simulator with Dynamic Simulations - Optimisation of the Radio Network Plan.

UNIT III WCDMA–GSM Co-Planning Issues: WCDMA–GSM Co-planning Issues - Radio Frequency Issues – Radio Network Planning Issues; Coverage and Capacity Enhancement Methods - Techniques for Improving Coverage - Techniques for Improving Capacity

Unit IV Radio Resource Management: Radio Resource Utilisation: Introduction to Radio Resource Management - Power Control - Handover Control - Congestion Control – Resource Management; RRU for High-speed Downlink Packet Access (HSDPA) - Impact of Radio Resource Utilisation on Network Performance.

Unit V Radio Network Optimisation: Radio Network Optimisation Process - Introduction to Radio Network Optimisation Requirements - Introduction to the Telecom Management Network Model - Tools in Optimisation; Advanced Analysis Methods and Radio Access Network Autotuning - Advanced Analysis Methods for Cellular Networks - Automatic Optimisation.

Recommended Books

- Jaana Laiho, Achim Wacker, Tomas Novosad, Radio Network Planning and Optimisation, John Wiley, 2006
- Morten Tolstrup, Indoor Radio Planning: A Practical Guide for GSM, DCS, UMTS and HSPA, John Wiley, 2008
- IanaSiomina, Radio Network Planning and Resource Optimization, LiU-Tryck, Link¨oping, Sweden, 2007

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MTWC-PE3C-18 Microwave and RF Design	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This Elective course is meant to recall the important fundamentals of the designs at Microwave and RF frequencies, its significance, applications and understand their technical concepts.

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand the significance of Microwave and RF designs.
2. Know the fundamentals behind Microwave Amplifiers/Oscillators designs
3. Technical know-how of Microwave and RF antennas concepts

Unit I Networks and Matrices: Scattering and chain scattering matrices, Generalized scattering matrix, Analysis of two port networks, Interconnection of networks. Positive real concepts, scattering matrix, representation of microwave components (directional coupler, circulators, hybrids and isolators).

Unit II High Frequency Circuit Design: Tuned Circuits, Filter design- Butterworth filter, Chebyshev filter, impedance matching. High frequency amplifier, BJT and FET amplifier, Broadband Amplifiers RF Oscillators, Colpitts, Hartley Oscillators, PLL. High Frequency Integrated Circuits.

Unit III Microwave Amplifier Design: Types of amplifiers, Power gain equations. Introduction to narrow band amplifiers basic concepts, Maximum gain design, Low noise design. High power design, Negative resistance, reflection amplifiers – various kinds – stability considerations, Microwave transistor amplifier design – input and output matching networks – constant noise figure circuits.

Unit IV Microwave Transistor Oscillator Design: One port and two port negative resistance oscillators. Oscillator configurations, Oscillator design using large signal measurements, Introduction to Microwave CAD packages, Microwave integrated circuits, MIC design for lumped elements.

Unit V RF and Microwave Antennas: Radiation from surface current and line current distribution, Basic Antenna parameters, Feeding structure-Patch Antenna, Ring Antenna, Micro strip dipole, Micro strip arrays, Traveling wave Antenna, Antenna System for Mobile Radio-Antenna Measurements and Instrumentation. Propagation characteristics of RF and Microwave signals, Introduction to EBG structures.

Recommended Books

- Matthew M. Radmanesh, RF and Microwave Design Essentials, Author House, Bloomington, 2007
- Daniel Dobkin, RF Engineering for Wireless Networks, Elsevier, London, 2005
- Reinhold Ludwig, Gene Bogdanov, RF Circuit Design – Theory and Applications, 2nd Edition, Pearson, 2012
- E.da Silva, High Frequency and Microwave Engineering, Butterworth Heinmann Publications, Oxford, 2001.
- David M. Pozar, Microwave Engineering, John Wiley and Sons,3rd Edition, 2005
- Kraus J. D, Marhefka. R. J. Khan A. S. Antennas for All Applications, 3rd Edition, Tata McGraw Hill, 2006
- Balanis A, Antenna Theory Analysis and Design, John Wiley and Sons, New York, Third Edition, 2005

MTWC-PE3D-18	Credits	L	T	P	Internal	External
Multimedia Communication and Technology	3	3	0	0	40	60

Course Objective

This Elective course is meant to recall the important fundamentals of the designs at Microwave and RF frequencies, its significance, applications and understand their technical concepts.

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand the fundamentals of multimedia system design..
2. Apply compression and decompression techniques to image, audio and video signals.
3. Differentiate between various multimedia input-output technologies and storage-retrieval technologies.
4. Learn the design aspects of multimedia applications

Unit I Multimedia Communication: An Introduction: Multimedia Information representation, Multimedia Networks: Telephone Network, Data Network, Broadcast Network etc, Multimedia Applications: Interpersonal communications, Entertainment applications etc, Application and Networking: Media Types, Network types etc, Technology of Multimedia.

Unit II Multimedia Information Representation: Introduction, Digitization principles: Analog Signals, Encoder design, Decoder Design, Text: Unformatted Text, Formatted text, Images: Graphics, Digitized documents etc, Audio: PCM speech, CD-quality audio, Video: Broadcast television.

Unit III Multimedia Compression (Text and Image): Introduction, Multimedia compression principles: Source encoders and destination decoders, Lossless and lossy compression, Entropy encoding, Source encoding, Text Compression: Static Huffman coding, Dynamic Huffman coding, Image compression: GIF, TIFF etc,

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Unit IV Multimedia Compression (Audio and Video): Audio Compression: Differential pulse code modulation, Linear predictive coding MPEG audio coders etc, Video Compression: Video compression principles, H.261, MPEG etc. Recent trends in Multimedia communication.

Recommended Books

- Andleigh P. K., Thakrar K., Multimedia Systems, Addison Wesley Longman, 1999
- Fred Halsall, Multimedia Communications, Pearson Education, 2000
- Ralf Steinmetz, Klara Nahrstedt, Multimedia, Computing, Communications and Applications, Prentice Hall, 1995
- Tay Vaughan, Multimedia making It work, TMH, 5th Edition 2001
- Weixel, Fulton, Barksdale.Morse, Multimedia Basics, Easwar Press, 2004

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PROGRAM ELECTIVES - IV

MTWC-PE4A-18	Credits	L	T	P	Internal	External
Cryptography and Wireless Security	3	3	0	0	40	60

Course Objective

This is one of the Elective courses that is meant to understand the important concepts of Cryptography, its mathematical formulation, applications, Authentication and system security techniques.

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand the significance of Cryptography
2. Know its Integrity, Authentication and Management
3. Learn the concepts of Security and threats to wireless systems.

Unit I Number Theory and Cryptography: Mathematics of cryptography - integer arithmetic, modular arithmetic, linear congruence, GF (2n), algebraic structures, primes, Euler's phi & totient functions, Fermat"s and Euler"s theorem, primality testing, factorization, CRT, quadratic congruence, exponentiation and logarithm, elliptic curve cryptosystem, symmetric key cryptography - substitution, transposition, modern block ciphers, and its applications.

Unit II Integrity, Authentication and Key Management: Introduction to message integrity, hash functions and digital signature, SHA-512, MAC & MDC, HMAC, CMAC, digital signature- DSA,ECDSA, Entity

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authentication-passwords, challenge-response, zero-knowledge, key management-PKI, symmetric key agreement, RSA ,ElGammal, information theory, and elementary probability, complexity of algorithm.

Unit III Security Practice & System Security: Electronic Mail Security – PGP, S/MIME, IPSec, Secure Electronic Transaction, web security considerations – SSL, TLS, IDS-password management, viruses and related threats, viruses counter measures, firewalls design principles, types of firewalls, configurations, trusted systems.

Unit IV Wireless Threats: Introduction to wireless technologies- history, challenges, risks, advances in wireless security, Radio Frequency –RF Terminology, interference, covert channels, and hardware. Hacking 802.11 wireless technologies- eavesdropping, jamming - wireless channel vulnerability analysis, Wi-Fi cyber crimes and awareness- countermeasures - wireless security standards wireless setup, risks and security controls.

Unit V Wireless Security: 802.11i - Attacks, WPA-EAP, Attacking 802.11 Networks- Basic Types Of Attacks, Security Through Obscurity, Defeating WEP, WEP attacks, 802.11 Authentication Types, Attacking WPA-Protected 802.11, Breaking WPA, LEAP,EAP-TLS, Tunneling EAP Techniques, Hacking Attacking 802.11i wireless technologies- Hacking hotspots, client attacks resources, threats of Bluetooth- advanced attacks- layer 2 fragmentations breaking the silence, layer 2 and layer 3 resolutions.

Recommended Books

- Behrouz Forouzan, Cryptography & Network Security, Tata McGraw Hill, 2008
- Johnny Cache, Vincent Liu, Hacking Exposed Wireless: Wireless Security secrets And Solutions, Tata McGraw Hill, 2007
- William Stallings, Cryptography & Network Security – Principles and Practices, Pearson Education, Fourth Edition, 2006
- Doughas R. Stinson, Cryptography-Theory and Practice, CRC Press,1995
- Wolfgang Osterhage, Wireless Security, CRC Press, 2011

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- Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Cengage Learning, 4th Edition, 2011

MTWC-PE4B-18 Software Defined radios and Cognitive Radio	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This is an interesting Elective course that is meant to understand the important concepts of Software defined Radios (SDR) as well as Cognitive radios, their significance, implementation and applications.

Course Outcomes

After the completion of this course, the student will be able to:

1. Learn Software Defined Radio concepts, architecture and SDR based end-to -end communication.
2. Understand communication setup between client and server through CORBA.
3. Apply SDR principles to smart antenna
4. Know the importance of frequency reuse through Cognitive Radio. Locate vacant spaces in spectrum through spectrum sensing techniques.

Unit I SDR concepts & history, Benefits of SDR, SDR Forum, Ideal SDR architecture, SDR Based End-to-End Communication, Worldwide frequency band plans, Aim and requirements of the SCA. Architecture Overview, Functional View, Networking Overview, Core Framework, Real Time Operating Systems.

Unit II Common Object Request Broker Architecture (CORBA), SCA and JTRS compliance, Radio Frequency design, Baseband Signal Processing, Radios with intelligence.

Unit III Smart antennas, Adaptive techniques, Phased array antennas, Applying SDR principles to antenna systems, Smart antenna architectures, Low Cost SDR Platform, Requirements and system architecture, Convergence between military and commercial systems, The Future For Software Defined Radio.

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Unit IV Cognitive Radio, concepts & history, frequency spectrum allocation, vacant spectrum sensing techniques. Efficient utilization of vacant holes in cognitive radio networks

Recommended Books

- Dillinger, Madani, Alonistioti (Eds.), Software Defined Radio, Architectures, Systems and Functions, Wiley, 2003
- Reed, Software Radio, Pearson
- Paul Burns, Software Defined Radio for 3G, 2002
- Tafazolli (Ed.), Technologies for the Wireless Future, Wiley 2005
- Bard, Kovarik, Software Defined Radio, the Software Communications Architecture, Wiley, 2007

MTWC-PE4C-18 Wireless and Optical Communication Networks	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This is an interesting Elective course that is meant to understand the important concepts of Wireless as well as Optical Communication networks, their significance, network components applications.

Course Outcomes

After the completion of this course, the student will be able to:

1. Learn Wireless Communication Network layers/technology .
2. Understand basic network components of Wireless and Optical Networks.

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3. Explain their applications

4. Know the importance of frequency reuse through Cognitive Radio. Locate vacant spaces in spectrum through spectrum sensing techniques.

Unit I Wireless Communication Networks: 3G Overview, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, 4G features and challenges, Technology path, IMS Architecture - Introduction to wireless LANs -IEEE 802.11 WLANs - Physical Layer- MAC sublayer.

Unit II MIMO Communication: Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain: Beamforming, Diversity-Multiplexing trade-offs, Space time Modulation and coding : STBC,STTC, Spatial Multiplexing and BLAST Architectures.

Unit III Optical Communication networks: Introduction: circuit switching and packet switching, optical layer, network evolution. Optical networking components/building blocks: Optical fibers, Optical transmitter, receiver and filters, multiplexers, switching elements, wavelength converter, and optical amplifiers. Client layers of the optical layer, WDM network elements. Optical switching: Packet switching, burst switching, MEMs based switching.

Unit IV Optical Metro Network: SONET/SDH, Fault management in SONET/SDH. Optical Access Network: Access networks, Photonic packet switching. Deployment considerations. Overview of PON technologies, Ethernet access network, WDM-PON. Control and management, network survivability, protection schemes.

Recommended Books

- Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.
- HARRY R. ANDERSON, "Fixed Broadband Wireless System Design" John Wiley – India, 2003.
- Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.
- Simon Haykin & Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.

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- Rappaport. T.S., "Wireless communications", Pearson Education, 2003.
- John M. senior, 'Optical fiber communication,' PHI
- G.E. Keiser, 'Optical fiber communication,' McGraw Hill
- P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ

MTWC-PE4D-18 **MIMO Systems**	**Credits**	**L**	**T**	**P**	**Internal**	**External**
	3	3	0	0	40	60

Course Objective

The purpose of the course is to provide a comprehensive coverage of coding techniques for multiple-input, multiple-output (MIMO) communication systems.

Course Outcomes

After completing this course the student will be able to:

1. Understand Basic MIMO communication systems
2. Explore Space-time block codes & Space-time trellis codes
3. MIMO systems for frequency-selective (FS) fading channels

Unit I FADING CHANNEL AND DIVERSITY TECHNIQUES: Wireless channels – Error/Outage probability over fading channels – Diversity techniques – Channel coding as a means of time diversity – Multiple antennas in wireless communications.

Unit II CAPACITY AND INFORMATION RATES OF MIMO CHANNELS: Capacity and Information rates of noisy, AWGN and fading channels – Capacity of MIMO channels – Capacity of non-coherent MIMO channels – Constrained signaling for MIMO communications.

Unit III SPACE TIME BLOCK AND TRELLIS CODES: Transmit diversity with two antennas: The Alamouti scheme – Orthogonal and Quasi-orthogonal spacetime block codes – Linear dispersion codes – Generic

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space-time trellis codes – Basic space-time code design principles – Representation of space-time trellis codes for PSK constellation – Performance analysis for space-time trellis codes – Comparison of space-time block and trellis

Unit IV FREQUENCY SELECTIVE FADING CHANNELS MIMO: frequency-selective channels – Capacity and Information rates of MIMO FS fading channels – Space - time coding and Channel detection for MIMO FS channels – MIMO OFDM systems.

Recommended Books

- Tolga M. Duman and Ali Ghrayeb, "Coding for MIMO Communication systems", John Wiley & Sons, West Sussex, England, 2007.
- A.B. Gershman and N.D. Sidiropoulus, "Space-time processing for MIMO communications", Wiley, Hoboken, NJ, USA, 2005.
- E.G. Larsson and P. Stoica, "Space-time block coding for Wireless communications", Cambridge University Press, 2003.
- M. Janakiraman, "Space-time codes and MIMO systems", Artech House, 2004.
- H. Jafarkhani, "Space-time coding: Theory & Practice", Cambridge University Press, 2005.

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MTAXX-18 Audit Courses II

MTA105-18 Audit Course 2 Constitution of India	Credits	L	T	P	Internal	External
	Non-credit	0	0	0	S/US	S/US

Course Objective

This course is to

1. Understand the premises informing the twin themes of liberty and freedom from a civilrights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

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Unit 1:

History of Making of the Indian Constitution:History, Drafting Committee, (Composition & Working).

Unit 2:

Philosophy of the Indian Constitution:Preamble, Salient Features.

Unit 3:

Contours of Constitutional Rights & Duties:Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State PolicyFundamental Duties.

Unit 4:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit 5:

Local Administration: District's Administration head: Role and Importance,Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials,Importance of grass root democracy.

Unit 6:

Election Commission:Election Commission: Role and Functioning, Chief Election, Commissioner and Election Commissioners, State Election Commission: Role and Functioning,Institute and Bodies for the welfare of SC/ST/OBC and women.

Recommended Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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MTA106-18	Credits	L	T	P	Internal	External
Audit Course 2 **Pedagogy Studies**	Non-credit	0	0	0	S/US	S/US

Course Objective

This course is to inculcate better teaching methods/tools for future teachers to build a better education system to compete with the developed nations pedagogical practices

Course Outcomes

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit 1:

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

Unit 2:

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Unit 3:

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Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included, studies, How can teacher education (curriculum and practicum) and the school, curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence foreffective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4:

Professional development: alignment with classroom practices and follow-up support Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit 5:

Research gaps and future directions- Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Recommended Books :

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf

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MTA107-18	Credits	L	T	P	Internal	External
Audit Course 2 **Stress Management By Yoga**	Non-credit	0	0	0	S/US	S/US

Course Objective

This course helps to achieve overall health of body and mind and overcome stress

Course Outcomes

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

Unit 1:

Definitions of Eight parts of yog. (Ashtanga)

Unit 2:

Yam and Niyam, Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit 3:

Asan and Pranayam, i) Various yog poses and their benefits for mind & body ii) Regularization of breathing techniques and its effects-Types of pranayam.

Recommended Books:

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1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama(Publication Department), Kolkata

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MTA108-18	Credits	L	T	P	Internal	External
Audit Course 2 Personality Development Through Life Enlightenment Skills	Non-credit	0	0	0	S/US	S/US

Course Objective

This course helps to learn toachieve the highest goal happily, become a person with stable mind, pleasing personality and determination and awaken wisdom in students

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

Unit 1:

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's).

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Unit 2:

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Approach to day to day work and duties, Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

Unit 3:

Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63.

Recommended Books :

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya SanskritSansthanam, New Delhi.

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THIRD SEMESTE

PROGRAM ELECTIVES - V

MTWC-PE5A-18	Credits	L	T	P	Internal	External
Millimeter Wave Communication and Technology	3	3	0	0	40	60

Course Objective

This is one of the Elective courses that is meant to understand the important concepts of MM Wave Communication & Technology, its characteristice, standards, applications.

Course Outcomes

After the completion of this course, the student will be able to:

1. Learn millimetre wave characteristics, standards and applications.
2. Recognize design considerations for millimetre wave antenna, concepts of beamforming and beam steering.
3. Learn modulation techniques used in transceiver design and link budget.
4. Explain MIMO system for millimetre wave communication.

Unit I Multi Gigabit 60-GHz Millimeter Wave Radios: Millimeter wave characteristics-Channel performance at 60GHz, Gigabit wireless communication, Comparison of Three Technologies for Gigabit Wireless Communications, Possible Applications for Millimeter Wave Communications, Coexistence with wireless backhaul.

Unit II Millimeter Wave Transceivers: Millimeter wave link budget, 60 GHz transmitter, receiver, and wireless link, Modulation techniques-OOK, PSK, FSK, QAM, OFDM.

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Unit III Advanced Beam Steering and Beam Forming: Need for beam steering and beam forming, Beam steering of a narrow-beam antenna having a main antenna radiation pattern, System model of phase array antennas,

UNIT IV Adaptive frame structure: Frame structure to enable beam steering or beam forming, Channel sounding frame and data frame, Adaptive frame structure to reduce the CSF overhead, Long data frame and short data frame, Advanced beam steering technology, Acquisition and tracking algorithm for beam steering, Flowchart of beam steering algorithm, Advanced beam forming technology, Advanced antenna ID technology.

Unit V Millimeter Wave MIMO: Spatial diversity of antenna arrays, Multiple antennas, Multiple transceivers.

Recommended Books

- Kao-Cheng Huang, Zhaocheng Wang, *Millimeter wave communication systems,* John Wiley & Sons, Hoboken, New Jersey, 2011
- Jonathan Wells, *Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications,* Artech House, 2010
- Su-Khiong Yong, Pengfei Xia, Alberto Valdes-Garcia, *60GHz Technology for Gbps WLAN and WPAN: From Theory to Practice*, Wiley 2010

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MTWC-PE5B-18 Space Time Wireless Communication	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This is one of the Elective courses that is meant to understand the important concepts of Space time Wireless Communication, Channel, Multiple Antenna Propagation, Capacity and Space diversity.

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand Space Time Channel Characterization
2. Explain Capacity of Multiple Antenna Channels
3. Learn ST OFDM, Spread Spectrum

Unit I Multiple Antenna Propagation and ST Channel Characterization: Wireless channel, Scattering model in macrocells, Channel as a ST random field, Scattering functions, Polarization and field diverse channels, Antenna array topology, Degenerate channels, reciprocity and its implications, Channel definitions, Physical scattering model, Extended channel models, Channel measurements, sampled signal model, ST multiuser and ST interference channels, ST channel estimation.

Unit II Capacity of Multiple Antenna Channels: Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Influence of ricean fading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequency selective MIMO channels.

Unit III Spatial Diversity: Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity, Indirect transmit diversity, Diversity of a space-time- frequency selective fading channel.

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Unit IV Multiple Antenna Coding and Receivers: Coding and interleaving architecture, ST coding for frequency flat channels, ST coding for frequency selective channels, Receivers (SISO, SIMO, MIMO), Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for maximum rate, optimal pre-filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

Unit V OFDM, Spread Spectrum and MIMO Multiuser Detection: SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMO- OFDM,SISO-SS modulation, MIMO-SS modulation, Signaling and receivers for MIMO- S.MIMO-MAC,MIMO-BC, Outage performance for MIMO-MU,MIMO-MU with OFDM,CDMA and multiple antennas.

Recommended Books

- Paulraj, Rohit Nabar, Dhananjay Gore, *Introduction to Space Time Wireless Communication Systems*, Cambridge University Press, 2003
- Sergio Verdu, *Multi User Detection*, Cambridge University Press, 1998
- Andre Viterbi, *Principles of Spread Spectrum Techniques*, Addison Wesley 1995

MTWC-PE5C-18	Credits	L	T	P	Internal	External
Advanced Techniques for Wireless Reception	3	3	0	0	40	60

Course Objective

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This Elective course is meant to explore the important concepts of Wireless Reception taking due consideration on Wireless signaling environment, Multiuser detection, CDMA, OFDM, MIMO Systems

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand Wireless Signaling Environment
2. Explain the usage of Multiuser detection
3. Learn CDMA, OFDM, MIMO systems

Unit I: Wireless signaling environment, Basic signal processing for wireless reception. Linear receivers for synchronous CDMA. Blind and group-blind multiuser detection methods.

Unit II: Robust multiuser detection for non Gaussian channels; asymptotic performance. Adaptive array processing in TDMA systems. Optimum space-time multiuser detection.

Unit III: CDMA- Encoder and decoder, difference between IS-95 and WCDMA, RAKE receiver- basic idea, propagation of transmitted signal, multipath, applications of RAKE receiver.

Unit IV: OFDM system and principle, multicarrier modulation, guard interval and inter symbol interference, cyclic prefix, equalization, advantages and disadvantages.

Unit V: MIMO multi input multi output, history, wireless channel and its characteristics, capacity of MIMO system, MIMO design criterion, diversity, space time for wireless communication, variants of multiple antenna system.

Recommended Books

- X. Wang, H. V. Poor, Wireless Communication Systems, Pearson, 2004
- R. Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Kluwer, 2001
- Mohamed Ibnkahla, Signal Processing for Mobile Communications, CRC Press, 2005

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- V. H. Sheikh, Wireless Communications Theory & Techniques, Kluwer Academic Publications, 2004
- Paulraj, Introduction to Space-time Wireless Communications, Cambridge University Press, 2003

MTWC-PE5D-18 Emerging Technologies of Wireless Communication	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This Elective course is meant to explore the important concepts of Wireless Communication and its emerging technologies like GPRS, UMTS, WiFi, WiMAX, UWB, CDMA, OFDM, MIMO Systems

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand the concept of cellular/wireless communication
2. Explain the Mobile Radio Propagation and Multiuser systems
3. Learn technologies of GPRS, UMTS, WiFi, WiMAX, Ultra Wideband communications, 4G and beyond 4G

Unit I Introduction to Wireless Communication: The Cellular concept, System design, Capacity improvement in cellular systems, Co channel interference reduction. Intelligent cell concept and applications. Technical Challenges.

Unit II Mobile Radio Propagation: Reflection, Diffraction. Fading. Multipath Propagation. Channel modeling, Diversity Schemes and Combining Techniques. Design parameters at the base station, Practical link budget design using path loss models. Smart antenna systems, Beam forming. MIMO Systems. RAKE receiver.

Unit III Multiuser Systems: CDMA- Principle, Network design, Link capacity, Power control, CDMA Network planning, MC-CDMA, OFDM.

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Unit IV Cellular mobile communication beyond 3G: GSM, IS-95, GPRS, UMTS, WiFi, WiMAX, Ultra Wideband communications, 4G and beyond 4G.

Recommended Books

- F. Molisch, Wireless Communications, Wiley, 2005
- Goldsmith, Wireless Communications, Cambridge University Press, 2005
- P. Muthu Chidambara Nathan, Wireless Communications, PHI, 2008
- Ke-Lin Du, M. N. S. Swamy, Wireless Communication Systems", Cambridge University Press, 2010
- K. Fazel, S. Kaiser, Multi-carrier and Spread Spectrum Systems, Wiley, 2003
- S.G. Glisic, Advanced Wireless Communications, 4G Technologies, Wiley, 2004
- W. C. Y.Lee, Mobile Communication Engineering, 2nd Edition, McGraw- Hill, 1998.
- S.G. Glisic, Adaptive CDMA, Wiley, 2003

MTWC-PE5E-18	Credits	L	T	P	Internal	External
Microstrip Antennas	3	3	0	0	40	60

Course Objective

This Elective course is meant to explore the important concepts of Micro-strip Antenna systems, methods to analyze them, their configurations, applications.

Course Outcomes

After the completion of this course, the student will be able to:

1. Understand the basic concept of micro-strip antennas, methods of analysis and configurations.
2. Explain micro-strip antennas arrays.
3. Understand the physical significance of discontinuities.
4. Learn coupled micro-strip line with multiband and broadband behavior.

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UNIT I - Micro-Strip Lines: Introduction of Planar Transmission Structures, Micro-strip Field Configuration, Micro-strip Dispersion Models, Micro-strip Transitions, Micro-strip measurement, Methods of Full wave Analysis, Analysis of an Open Micro-strip, Analysis of an Enclosed Micro strip, Design Considerations, Suspended and Inverted Micro-strip Lines, Multilayered Dielectric Micro-strip, Thin Film Micro-strip (TFM), Valley Micro-strip Lines, Micro-strip Applications.

UNIT II - Micro-Strip Antenna Arrays: Array theory, Array calculations and analysis, array architectures, corporate array design, Resonant series fed array design, Series fed traveling wave array design. Micro-Strip Discontinuities: Introduction of Quasi-Static Analysis and Characterization, Discontinuity Capacitance Evaluation, Discontinuity Inductance Evaluation, Characterization of Various Discontinuities, Planar Waveguide Analysis, Full wave Analysis of Discontinuities, Discontinuity Measurements.

UNIT III - Slot-Line: Introduction of Slot-lines, Slot-line Analysis, Design Considerations, Slot-line Discontinuities, Slot-line Transitions, Slot-line Applications. Coplanar Lines and Wave Guides: Introduction of Coplanar Waveguide and Coplanar Strips, Quasi-Static Analysis, Design Considerations, Losses, Effect of Tolerances, Comparison with Micro-strip Line and Slot-line, Transitions, Discontinuities in Coplanar Waveguide, Coplanar Line Circuits.

UNIT IV - Coupled Micro-Strip Lines: Introduction of Coupled Micro-strip Lines, General Analysis of Coupled Lines, Characteristics of Coupled Micro-strip Lines, Measurements on Coupled Microstrip Lines, Design Considerations for Coupled Micro-strip Lines, Coupled Multi conductor Micro-strip Lines, Discontinuities in Coupled Micro-strip Lines. Micro-Strip Circuit Design: impedance transformers, filters, isolators and phase shifters.

Recommended Books

- Gupta, K.C. and Garg, Ramesh, Micro-strip lines and slot lines, Artech house (1996).
- Sainiti, Robert A., CAD of Micro-strip Antenna for Wireless Applications, Artech House (1996).
- Lu, Wong Kim, Planar antennas for Wireless applications, John Wiley and Sons (2003).
- Simons, Rainee N., Coplanar Waveguide Circuits, Components, and Systems, John Wiley and Sons (2001).

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MTOE-301X-18 Open Electives

MTOE-301A-18 Open Elective Cost Management of Engineering Projects	Credits	L	T	P	Internal	External
	3	3	0	0	40	60

Course Objective

This is course deals with strategic cost management for engineering projects and useful quantitative techniques to implement

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand the cost calculation for decision-making about an engineering research project
2. Able to define Role of each member in the project team
3. Manage the project by applying Quantitative techniques for cost management

Unit 1

Introduction and Overview of the Strategic Cost Management Process

Unit 2:

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

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Unit 3:

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit 4:

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Recommended Books :

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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MTOE-301B-18	Credits	L	T	P	Internal	External
Open Elective Composite Materials	3	3	0	0	40	60

Course Objective

This is course deals with Composite Materials and preparation/manufacturing of Metal Matrix Composites

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand the characteristics of Composite materials and their advantages and applications
2. Get exposure to Manufacturing of Metal Matrix Composites: Knitting, Braiding, Weaving and estimate Strength

Unit 1

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

Unit 2:

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostressconditions.

Unit 3:

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

Unit 4:

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications

Unit 5:

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insightstrength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Recommended Books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K.K.Chawla.
5. Composite Materials Science and Applications – Deborah D.L. Chung.
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-301C-18	Credits	L	T	P	Internal	External
Open Elective Waste to Energy	3	3	0	0	40	60

Course Objective

This is course deals with effective and cheap methods to convert waste into useful energy.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand various methods to convert agro, forest and industrial residue to useful energy
2. Get exposure Biomass Combustion, Biomass Gasification etc.

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Unit 1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit 2:

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit 3:

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kineticconsideration in gasifier operation.

Unit 4:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs,Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design,construction and operation - Operation of all the above biomass combustors.

Unit 5:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion -Types of biogas Plants – Applications – Alcohol production from biomass - Bio diesel production -Urban waste to energy conversion - Biomass energy programme in India.

Recommended Books:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill
3. Publishing Co. Ltd., 1983.
4. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
5. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996

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MTWC-DS1-18	Credits	L	T	P	Internal	External
DISSERTATION PHASE I	10	0	0	20	60	40

Course Objectives: To prepare the students to develop research expertise and knowledge in the area of particular interest.

Course Outcomes: After the completion of the course, the student will be able to:

1. Critically analyse and evaluate existing knowledge about the chosen problem.
2. Find the gaps and motivation through literature survey.
3. Design the framework to optimize the solution for the problem.
4. Construct the research proposal.

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FOURTH SEMESTER

②

MTWC-DS2-18	Credits	L	T	P	Internal	External
DISSERTATION PHASE II	16	6	0	20	60	40

Course Objective: To enable the student to implement the proposed research work and publish their authentic results.

Course Outcomes: After the completion of the course, the student will be able to:

1. Implement the proposed framework practically or through simulation.
2. Gather the results and publish in the research articles.
3. Write-up the proposed work, results with conclusion and future work in the form of thesis.
4. Present the research work before a committee.

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I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref. No. : IKGPTU/Reg/N/

Dated :

NOTIFICATION

Sub: **Regarding Pre-Ph.D Course work.**

This is for information of all concerned that Pre-Ph.D course work from 2016-17 will be conducted in the IKGPTU main campus Kapurthala in regular mode. The PhD course work will consists of minimum 15 credits. The structure of the course work is as under.

Sr. No.	Nature of course	Name of course	Credits	Remarks
1.	Core	1.Research Methodology	4	The syllabus of RM should be formulated faculty wise such as Engineering, Science, Management/ Humanities and Life sciences
		2.Subject related theory paper	4	Discipline specific related to advancements in theoretical methods for research
		3. Presentation	3	Discipline specific
2.	Interdisciplinary	4. Elective	4	From list of subjects from allied fields
	Total Minimum credits		15	

-Sd-
Registrar

Endorsement No: IKGPTU/REG/N/ 4244-4251

Dated: 22.08.2016

1. Secretary to Vice Chancellor: For kind information of Vice Chancellor
2. Dean (P&D)
3. Dean (RIC)
4. Dean (Academics)
5. Finance Officer
6. Controller of Examination
7. DR (Computers): For uploading on website
8. File Copy

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Registrar 18/8/16

I. K. Gujral Punjab Technical University, Jalandhar
Jalandhar Kapurthala Highway, Near Pushpa Gujral Science City, Kapurthala - 144 603
Ph. No. 01822 - 662521, 662501 Fax No. : 01822-255506, 662526, Email : registrar@ptu.ac.in

Ref. No. : IKGPTU/Reg/NF/ 169

Dated : 23*.06.2021*

NOTIFICATION

Sub: Introduction of two credit course "Research and Publication Ethics (RPE).

I.K. Gujral Pujnab Technical University, Jalandhar has introduced a mandatory two credit course on "Research and Publication Ethics (RPE) for all Ph.D students in their pre-registration course work from January 2021 onwards. The course content/ structure as per UGC guidelines (letter No.D.O.No.F.1-1/2018 (Journal/CARE) dated December 2019) has been included in Ph.D. course work. The details are as follows:

Research and Publication Ethics (RPE)
(2 Credits)

1. Course structure

- The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit title	Teaching hours
Theory		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
Practice		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Database and Research Metrics	7
	Total	**30**

Syllabus (as suggested by UGC)

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THEORY

- **RPE 01: PHILOSOPHY AND ETHICS (3hrs.)**

1. Introduction to Philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral Philosophy, nature of moral judgements and reactions

- **RPE 02: SCIENTIFIC CONDUCT (5hrs.)**

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data

- **RPE 03: PUBLICATION ETHICS (7hrs.)**

1. Publication Ethics: definition, introduction, and importance
2. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types.
5. Violation of publication ethics, authorship, and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

PRACTICE

- **RPE 04: OPEN ACCESS PUBLISHING (4hrs.)**

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies.
3. Software tool to identify predatory publications developed by SPPU.
4. Journal finder/journal suggestion tool viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

- **RPE 05: PUBLICATION MISCONDUCT (4hrs.)**

A. Group Discussion (2hrs.)

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

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B. Software tools (2hrs.)

Use of plagiarism software like Turnitin, Urkund, and other open-source software tools.

- **RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)**

A. Databases (4hrs.)

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

B. Research Metrics (3hrs.)

1. Impact Factor of journal as per Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g-index, i10 index, altmetrics

2. Course Work Structure – 17 Credits

All candidates admitted to Ph.D programme shall be required to complete the Ph.D course work, proposed by the Supervisor keeping in view the candidate's areas of research in the University Teaching Department. Pre Ph.D course work will be **17 credits and shall be offered on regular** basis at IKGTU campus.

Structure of course work is as under:

Sr. No.	Nature of Course	Name of Course	Credits	Remarks
1	Core	1. Research Methodology	4	The syllabus of RM should be formulated faculty wise such as Engineering, Sciences, Management/ Humanities and Life Sciences
		2. Subject Related theory paper	4	Discipline specific related to Advancements in theoretical methods for research.
		3. Presentation	3	**Discipline specific**
2.	Interdisciplinary	4. Elective	4	From list of Subjects from allied fields
3.	Research and Publication Ethics (RPE)	5. Research and Publication Ethics (RPE)	2	As Per UGC
	Total Minimum credits		**17**	

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a. The candidate will have to clear Courses within the first two semesters as per the programme of the Department.

b. Direct fellowship awardees or candidates registered for Ph.D. during the middle of the semester will take up course work in the following semester

c. The syllabus for the Pre-Ph.D. course work, not covered in the ongoing PG curriculum, will be drawn by the Board of Studies or RAC subject to the approval by BoS and highest academic body of the University.

d. An Attendance less than the mandatory 75% (including 10% attendance benefit on medical grounds) in the course work shall attract cut in the scholarship /fellowship.

3. Applicability:

It is decided that the 17 credit course work will be applicable to all students which are enrolled from January 2021 onwards.

(Sandeep Kumar Kazal)
Registrar

Endst. No. IKGPTU/Reg/NF/170-174 **Dated:**23**.06.2021**

A copy is forwarded to the following officers for information please.

1. Vice Chancellor Secretariat: For information of Vice Chancellor
2. Dean (R&D)
3. Director (Main Campus): To inform all Deputy Dean (Faculty), HoDs (Teaching) and In-charge, Constituent Campuses
4. Director/Principal, Autonomous College
5. Incharge (ITS): For upload of notice in the Notice Board of University website and Ph.D admissions link also.

(Sandeep Kumar Kazal)
Registrar

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Pre Ph.D. Course in Electronics and Communication Engineering
Schematic and Syllabus

Sr. no.	Nature of Course	Name of course	Credits	Remarks
1.	Core	Research Methodology	4	The syllabus of RM should be formulated faculty wise
		Discipline Specific subjects	4	1.Advanced Wireless Communication 2.Advanced Communication Systems 3.Advanced Digital Signal processing 4.Real time concepts for Embedded systems 5. Radiating systems 6. Microwave and Millimeter wave circuits 7. RF & Microwave System Design 8. Image and Video Processing 9. Bio-Medical Signal Processing 10. MOS Circuit Design 11. Low Power VLSI Circuits 12. Advanced Data Communication 13. Coding Theory and Techniques 14. Optical Communication Technology 15. Optical Networks.
		Presentation	3	Discipline specific
2.	Interdisciplinary	Elective	4	From list of subjects from allied fields 1.Internetworking 2. MEMS 3. Network Security and Cryptography 4. Adhoc Wireless and Sensor Netwroks 5. Mobile Computing Technologies 6. Data Warehousing and Data Mining 7. Neural Networks and Fuzzy Logic 8. Mathematical Foundations of Computer Networks 9. Sensors for Ranging and Imaging
3.	Research and Publication Ethics	Research and Publication Ethics (RPE)	2	As per UGC guidelines
	Total Minimum credits		**15**	

Paper Title: Research Presentation

L	T	P
0	0	3

Research Scholar will have to present a seminar based upon his/her research area. Performance of the scholar and participation in seminar will be taken into consideration.

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PROGRAMME OUTCOMES

1. Understand the key concepts, terminologies in the field of Electronics and Communication Engineering. Survey the available literature to discover a list of problems occurring in society in the field of Electronics and Communication.
2. Develop ability to critically analyse the problem, formulate the innovative framework to find the solution for it.
3. Review the literature, write survey and research articles.
4. Analyse and evaluate the gaps in the existing literature and gather new insights into it.
5. Find alternative solution to the problem which is economically feasible, socially acceptable and environment-friendly.
6. Develop the research design, conduct experiments, gather results- analyse and interpret them through technical knowledge to come to a valid conclusion.
7. Learn coding skills for modelling and error debugging and handling. Use latest engineering methods and software tools for problem solving.
8. Communicate effectively with peers and higher authorities both orally and in-writing in academic as well as industrial environment.
9. Familiar with ongoing research areas, technologies, electronic products and gadgets.
10. Engage in life-long learning as a means of enhancing knowledge and skills for continuous professional advancement.

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Pre Ph.D. Course in Electronics and Communication Engineering
Research Methodology

L	T	P
4	0	0

CO1: Identify and discuss the role and importance of research in the social sciences.
CO 2: Identify and discuss the issues and concepts salient to the research process.
CO 3: Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
CO4: Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

1. Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.
2. Identifying and defining research problem: Locating. Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them.
3. List of important journals in Electronics and Communication Engineering, impact factor. research articles, research papers, reviews, scientific popular articles, process of reviewing, literature review, Identification and formulation of problem, Research design, Sampling techniques, Data Collection, Statistical and sensitive analysis of data, Interpretation of result.
4. Research reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, word processing tools such as Latex Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.
5. Statistical Methods of Analysis: Descriptive statistics: Meaning, graphical representations. mean, range and standard deviation, characteristics and uses of normal curve. Inferential statistics: t-test. Chi-square tests. Correlation (rank difference and product moment), ANOVA (one way).
6. Research ethics, IPR and publishing Ethics: ethical issues. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Books:

1. C.R. Kothari, "Research Methodology – Methods and Techniques", Wiley Eastern Ltd 2009.
2. Richard I. Levin, David S. Rubin, Statistics for Management (7th Edition), Pearson Education India.
3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods and Techniques, Pearson, 2006 4. S.P Gupta,"Statistical Methods", Sultan Chand & Sons, 2006.
4. Probability and Statistics in Engineering, Hines, Montgomery, Goldsman and Borror, 4th ed, 2003, John Wiley & Sons.
5. B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.

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Pre Ph.D. Course in Electronics and Communication Engineering

Advanced Wireless Communication

L	T	P
4	0	0

CO1: To understand the wireless channel characteristics and its statistical models. Review of necessary mathematical tools, e.g., probability theory, optimization theory, information theory.

CO 2: To be well versed with the popular wireless communications technologies, e.g., CDMA, OFDM, MIMO.

CO 3: To understand the achievable capacity of digital communications over time-varying fading channels.

CO 4: To be able to understand modern multi-antenna systems, i.e., MIMO and related transmitter and receiver structures.

CO5: To be able to formulate adaptive power and rate control in OFDM and MIMO systems.

1. REVIEW OF FUNDAMENTALS OF WIRELESS COMMUNICATION: MULTIPATH FADING, MULTIPATH CHANNEL MODELS, CAPACITY OF WIRELESS CHANNELS.

2. PERFORMANCES OF DIGITAL MODULATION OVER WIRELESS CHANNELS: AGWN CHANNELS SIGNAL TO NOISE POWER RATIO AND BIT/SYMBOL ENERGY, ERROR PROBABILITY FOR BPSK, QPSK, MPSK,MPAM, MQAM- THEIR COMPARISION.

3. MULTICARRIER MODULATION: DATA TRANSMISSION USING MULTIPLE CARRIERS, MULTICARRIER MODULATUION WITH OVERLAPPING SUBCHANNELS, MITIGATION OF SUBCARRIER FADING, DISCRETE IMPLEMENTATION OF MULTICARRIER MODULATION, CHALLENGES IN MULTICARRIER SYSTEMS.

4. INTRODUCTION TO WIRELESS OFDM: OFDM PRINCIPLES, SYSTEM MODEL, GENERATION OF SUB CARRIER USING IFFT, GUARD TIME, CYCLIC EXTENSION, WINDOWING, OFDM PARAMETERS, OFDM SIGNAL PROCESSING, COHERENT AND DIFFERENTIAL DETECTION

5. OFDMA: FREQUENCY HOPPING IN OFDMA, DIFFERENCE BETWEEN OFDMA AND MC-CDMA, OFDMA SYSTEM DESCRIPTION-CHANNEL CODING, FREQUENCY SYNCHRONIZATION, INITIAL MODULATION TIMING ANF FREQUENCY OFFSET SYNCHRONIZATION ACCURACY, RANDOM FREQUENCY HOPPING OPERATION, APPLICATIONS OF OFDMA.

Books:

1. A.Goldsmith, "Wireless Communications, Cambridge Univ. Press, 2005.
2. R.Vannee and R.Prasad, "OFDM for Wireless Multimedia Communication, Artech House. 2000.
3. M.Engels, Wireless OFDM systems, Klumer Academic Publishers, 2002.
4. Raj Pandya,"Mobile and personal Communication Systems and services", PHI
5. Theodore S. Rappaport, 'Wireless Communications Principles & Practice', PHI,2007
6. J.W. Mark & W. Jhuang. 'Wireless Communications & Networking', PHI,2006

Pre Ph.D. Course in Electronics and Communication Engineering

Advanced Communication Systems

L	T	P
4	0	0

CO1: 1. Analyze the design parameters of a single and multi-carrier communication system.
CO 2: Use mathematical tools to analyze the performance of communication systems.
CO 3: Use probability theory and stochastic processes in communication system applications.
CO 4: Learn synchronization and adaptive equalization techniques.

1. Introduction Introduction to communications systems, analog and digital communication systems, Applications of communication systems.
2. Digital Communication Introduction, Digital Modulation techniques, BPSK, QPSK, PCM, DPCM, Delta Modulation, Digital Transmission and Transmission Impairments.
3. Optical Networks WDM, TDM, Telecommunication Infrastructure, Switching, 3G systems, SONET, SDH, Architecture of Optical Transport Network, Link Management Protocols, Solutions.
4. Satellite Communication Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design Of Down Links, Domestic Satellite Systems Using Small Earth Stations, Uplink Design, Design Of Satellite Link For Specified (C/N). Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Estimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT
5. Mobile Communications Mobile telephone service, Transmission protocols, Introduction to GSM, GPRS, CDMA, Switching techniques, Fading, Quality of service (QOS).

Books:

1. Advanced Communication Systems - by Wayne Tomasi; Pearson.
2. Digital Communication - by Proakis; PHI
3. Optical Networks - by Uyless Black; Pearson
4. Satellite Communication - by Timothy Pratt; Addison Wesley.
5. Related IEEE/IEE publications

Pre Ph.D. Course in Electronics and Communication Engineering

Advanced Digital Signal Processing

L	T	P
4	0	0

CO1: State sampling theorem and reproduce a discrete-time signal from an analog signal; acquire knowledge of multi rate digital signal processing, STFT and wavelets.
CO 2: Classify systems based on linearity, causality, shift-variance, stability criteria and represent transfer function of the selected system.
CO 3: Evaluate system response of a system using Z-transform, convolution methods, frequency transformation technique, DFT, DIF-FFT or DIT-FFT algorithm, window techniques.
CO 4: DesignFIR and IIR filters used as electronic filter, digital filter, mechanical filter, distributed element filter, waveguide filter, crystal filter, optical filter, acoustic filter, etc.
CO5: Construct (structure) and recommend environment-friendly filter for real- time applications.

1. Transformations: Review of Z-Transform, Solution of Linear Difference Equations, Fourier series and Fourier Transform, Discrete Fourier Transform, Radix-2 FFT. Introduction to Radix-4 and Split Radix FFT, Discrete Cosine Transform, DCT as Orthogonal Transform, Walsh Transform, Hadamard Transform, Wavelet Transform.
2. Digital Filters: FIR Filter Design: Filter Specifications, Coefficient Calculation Methods-Window method, Optimal method, Frequency Sampling method. Realization Structures, Finite Word Length Effects.IIR Filter Design: Specifications, Coefficient Calculation methods- Pole-Zero Placement method, Impulse Invariant method, Matched Z-Transform method, Bilinear Z Transformation method, Use of BZT and Classical Analog Filters to design IIR Filters, Realization Structures, Finite Word Length Effects.
3. Multirate Digital Signal Processing: Sampling Rate Alteration Devices, Multirate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, The Polyphase Decomposition, Arbitrary Rate Sampling Rate Converter, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform.
4. Linear Prediction and Optimum Linear Filters: Forward and Backward Linear Prediction, Properties of Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.
5. Adaptive Digital Filters: Concepts of Adaptive Filtering, LMS Adaptive Algorithm, Recursive Least Squares Algorithm, Applications.
6. DSP Chips: Introduction to fixed point and floating point processors, ADSP21xx and TMS320Cxx- Architecture, Memory, Addressing Modes, Interrupts, Applications. Comparison of ADSP21xx and TMS320Cxx series.

Books:

1. "Digital Signal Processing: A Practical Approach", by Ifeacher & Jervis, -Pearson Education.
2. "Digital Signal Processing: Principles, Algorithms and Applications", by Proakis & Manolakis, 4e, -Pearson Education.
3. "Digital Signal Processing", by S.K.Mitra, -Tata-Mcgraw Hill.
4. "Discrete Time Signal Processing", Oppenheim & Schafer. PHI.
5. "Fundamentals of Digital Signal Processing using MATLAB", by Robert J. Schilling & Sndra L. Harris. -CENGAGE Learning.
6. "Digital Signal Processing", by Salivahanan, Vallavaraj & Gnanapriya, - Tata-Mcgraw Hill

Pre Ph.D. Course in Electronics and Communication Engineering
Real Time Concepts for Embedded Systems

7

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CO1: Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.

CO 2: Make use of the enabling technologies for implementing embedded systems with emphasis on Microcontrollers from various vendors and the techniques for programming their integrated peripherals.

CO 3: Understand the interdisciplinary nature of various application fields of Embedded Systems.

1. Introduction: Examples of Embedded Systems, Definition of Embedded Systems, Architecture of Embedded Systems, Real- Time Embedded Systems , Design Issues and Current Trends for Embedded Systems Hard versus soft Real- Time Systems: Jobs and Processes, Release Times, Deadlines and Timing Constraints, Hard and Soft Timing Constraints, Hard Real Time Systems, Soft Real Time Systems.
2. Reference Model of Real – Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency, Functional Parameters- pre-emptivity of jobs, criticality of jobs, Resource Parameters of Jobs and Parameters of Resources, Scheduling Hierarchy- Scheduler and Schedules, Feasibility, Optimality and Performance Measures.
3. Classification of Real Time Scheduling Approaches: Clock- Driven Approach, Weighted Round- Robin Approach, Priority- Driven Approach, Dynamic versus Static Systems, Effective Release Times and Deadlines, optimality of the EDF and LST algorithms, Non optimality of the EDF and LST algorithms, Challenges in validating timing constraints in priority –driven systems Off-line versus On-line Scheduling.
4. Clock-Driven Scheduling : Notations and Assumptions, Static, Timer -Driven Scheduler, General Structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of Aperiodic Jobs, Scheduling Sporadic Jobs-Acceptance test ,EDF Scheduling of accepted jobs and implementation, Pros and Cons of Clock Driven Scheduling.
5. Priority-Driven Scheduling of Periodic Tasks: Static Assumption, Fixed Priority v/s Dynamic Priority Algorithms, schedulability test for the EDF algorithm, a schedulability test for fixed priority tasks with short response times-time demand analysis, schedulability test for fixed priority tasks with arbitrary response times: busy intervals, general schedulability test, sufficient schedulability conditions for RM & DM algorithms: schedulable utilization of the RM algorithm for tasks with Di=pi, schedulable utilization of fixed priority tasks with arbitrary relative deadlines.
6. Real-Time Operating Systems: Overview- Threads and Tasks, The Kernel, Time Services and Scheduling Mechanisms- Time Services, Scheduling Mechanisms, Other Basic Operating System Functions- Communication and Synchronization, Event Notification and Software Interrupt, Memory Management, I/O and Networking.

BOOKS:

1. Real Time Systems – By Jane W.S.Liu -Low Price Edition , Pearson Education Asia
2. Real-Time Concepts for Embedded Systems - Qing Li with Caroline Yao published by CMP Books

Pre Ph.D. Course in Electronics and Communication Engineering
Radiating Systems

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CO1: Define various antenna parameters and analyze radiation patterns of antennas.
CO 2: Analyze radiation patterns of antennas.
CO 3: Illustrate techniques for antenna parameter measurements.
CO 4: To understand the various applications of antennas and discuss radio wave propagation.

1. Basics Concepts Of Radiation: Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of Antennas, Impedance concept-Balanced to Unbalanced transformer.
2. Radiation from Apertures Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas.
3. Synthesis of Array Antennas Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques.
4. Micro Strip Antennas Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Micro-strip dipole, Microstrip arrays.
5. EMI/EMC/Antenna Measurements: Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Traveling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase measurement, Gain, Directivity, Impedance and polarization measurement, Antenna range, Design and Evaluation.

BOOKS

1. Kraus.J.D.,"Antennas"II Edition, John wiley and Sons.
2. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982
3. RF System Design, Peter Kinget Bell Laboratories, Lucent Technologies Murray Hill.
4. Practical RF system design, Wiley-IEEE, 2003 - Technology & Engineering

Pre Ph.D. Course in Electronics and Communication Engineering
Microwave and Millimeter Wave Circuits

L T P
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CO1: State the concept of MMIC and MM-wave technology along with their fabrication techniques.

CO 2: Comprehensive knowledge of the passive circuit elements for microwave and MM-wave technology.

CO 3: Enhance skills of different measurement techniques for microwave and MM-wave technology.

CO 4: Design systems and its application for microwave and MM-wave technology.

1. Analysis of Microwave Circuits: Introduction, Microwave Components – E-plane Tee, Hplane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering.
2. Transformers & Resonators: Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators.
3. Filters And Periodic Structures: Design of Narrow Band Low Pass, Band Pass and High Pass Filters, Maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures.
4. Obstacles In Wave Guides: Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures.
5. Millimeter Wave Circuits: Wave Propagation in micro-strip lines, Discontinues in Microstrips, Parallel Coupled lines, Power Dividers and Directional Couplers, Microwave and Millimeter Wave Integrated Circuits.

BOOKS

1. Roger F. Harrington, "Time-Harmonic Electromagnetic Fields". Mc graw-hill
2. Robert E Collin, "Foundation For Microwave Engineering", Mc Graw-Hill.
3. Cam Nguyun, "Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission Line Structures".

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CO1: Analyze, evaluate, design and solve complex technical problems using modern tools.
CO 2: Carry out research and innovation in the core areas like RF Circuit analysis, sub-system design and Wireless Communication.
CO 3: Demonstrate the skills required in Defense, Microwave and RF communication sectors and adapt to the technological changes through lifelong learning for global acceptance.

1. Introduction: Importance of RF and Microwave Concepts and Applications- and UnitsFrequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.

2. The Smith Chart: Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart. Distributed Circuit Applications, Lumped Element Circuit Applications. SINGLE AND MULTIPORT NETWORKS: Basic Definitions, Interconnecting Networks.

3. Scattering Parameters: Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion between S and Z-parameters, Signal Flow Chart Modeling.

4. Stability and Gain Considerations – RF Design RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, and Stabilization Methods-Unilateral and Bilateral Design for Constant Gain- Noise Figure Circles- Constant VSWR Circles.

5. RF Filters, Amplifiers And Oscillators Design Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters-Filter Implementation using Unit Element and Kuroda's Identities Transformations. Introduction, Types and Characteristics of Amplifiers, Small Signal Amplifiers, Design of different types of amplifiers (NBA, HGA, MGA, LNA, MNA, BBA), Design of Large Signal Amplifiers Oscillator vs Amplifier Design, Design procedure of Transistor Oscillators.

BOOKS

1. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition.
2. Reinhold Ludwig and Powel Bretchko," RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition.\
3. Devendra K. Misra, "Radio Frequency and Microwave Communication Circuits – Analysis and Design "John Wiley & Sons, Inc.
4. Jon B. Hagen, "Radio Frequency Electronics ", Cambridge university press, Cambridge, 1996.
5. James Hardy, "High Frequency Circuit Design ", Resto Publishing Co., New York, 1979.

Pre Ph.D. Course in Electronics and Communication Engineering

Image and Video Processing

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CO1: Review the fundamental concepts of a digital image processing system.
CO 2: Analyze images in the frequency domain using various transforms.
CO 3: Evaluate the techniques for image enhancement and image restoration and categorize various compression techniques.
CO 4: Interpret Image compression standards and Interpret image segmentation and representation techniques.

1. Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.
2. Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation.
3. Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless. Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.
4. Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.
5. 2-D Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

BOOKS

1. Gonzalez and Woods , "Digital Image Processing", 3rd edition , Pearson
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication", 1st edition, PHI.
3. M. Tekalp, "Digital video Processing", Prentice Hall International

Pre Ph.D. Course in Electronics and Communication Engineering

Bio Medical Signal Processing

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CO1: The student will be able to model a biomedical system.

CO 2: The student will be able to understand various methods of acquiring bio signals.

CO 3: The student will be able to understand various sources of bio signal distortions and its remedial techniques.

CO 4: The students will be able to analyze ECG and EEG signal with characteristic feature points.

CO5: The student will have a basic understanding of diagnosing bio-signals and classifying them.

1. Introduction To Biomedical Signals - Examples of Biomedical signals - ECG, EEG, EMG etc., Tasks in Biomedical Signal Processing - Computer Aided Diagnosis. Origin of bio potentials - Review of linear systems - Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals- Processing of Random & Stochastic signals – spectral estimation – Properties and effects of noise in biomedical instruments - Filtering in biomedical instruments.
2. Concurrent, Coupled and Correlated Processes - Illustration with case studies – Adaptive and optimal filtering - Modeling of Biomedical signals - Detection of biomedical signals in noise -removal of artifacts of one signal embedded in another -Maternal-Fetal ECG - Musclecontraction interference. Event detection - case studies with ECG & EEG - Independent component Analysis - Cocktail party problem applied to EEG signals - Classification of biomedical signals.
3. Cardio Vascular Applications : Basic ECG - Electrical Activity of the heart- ECG data acquisition – ECG parameters & their estimation - Use of multi-scale analysis for ECG parameters estimation - Noise & Artifacts- ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection - Arrhythmia analysis
4. Data Compression: Lossless & Lossy- Heart Rate Variability – Time Domain measures - Heart Rhythm representation - Spectral analysis of heart rate variability - interaction with other physiological signals.
5. Neurological Applications: The electroencephalogram - EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models – Non-linear modeling of EEG - artifacts in EEG & their characteristics and processing – Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis – correlation analysis of EEG channels - coherence analysis of EEG channels.

BOOKS

1. D.C.Reddy ,"Biomedical Signal Processing: Principles and techniques" ,Tata McGraw Hill, New Delhi, 2005

2. Willis J Tompkins , Biomedical Signal Processing -, ED, Prentice – Hall, 1993

3. R. Rangayan, "Biomedical Signal Analysis", Wiley 2002. 2. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley, 2001

MOS Circuit Design

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CO1: Understand the basic physics of semiconductor devices and the basics theory of PN junction.

CO 2: Understand the basic theory of MOS transistors and Understand the basic steps of fabrication.

CO 3: Learn the basics theory of Crystal Growth and Wafer Preparation.

CO 4: Study the Epitaxy, Diffusion, Oxidation, Lithography and Etching and understand the basic theory of Nano-Fabrication.

1. Introduction: Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS nwell process, layout design rules.
2. MOS Transistor and Circuit Modeling: MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modeling of MOS transistor using SPICE.
3. MOS Inverter static characteristics and Interconnect Effects: Introduction, ResistiveLoad Inverter, Inverter with n-type MOSFET load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.
4. Combinational and Sequential MOS logic Circuits: Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bi-stable elements, SR latch circuit, clocked latch and flipflop circuits, CMOS D-latch and Edge-triggered flip-flop.
5. Dynamic logic Circuits: Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, Highperformance dynamic CMOS circuits.

BOOKS

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits" TMH 2003
2. Neil H. E. Weste and David. Harris Ayan Banerjee., "CMOS VLSI Design" - Pearson Education, 1999.
3. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits" Pearson Education, 2003
4. Uyemura, "Introduction to VLSI Circuits and Systems" Wiley-India, 2006.
5. Wayne Wolf, "Modern VLSI Design ", 2nd Edition, Prentice Hall, 1998.
6. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, "Essentials of VLSI Circuits and Systems" – PHI, EEE, 2005 Edition.

SIMULATION BOOK 1. Etienne Sicard, Sonia Delmas Bendhia, "Basics of CMOS Cell Design", TMH, EEE, 2005.

Pre Ph.D. Course in Electronics and Communication Engineering

Low Power VLSI Circuits

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CO1: Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon technologies.

CO 2: Students able to understand deep submicron CMOS technology and digital CMOS design styles.

CO 3: To design chips used for battery-powered systems and high-performance circuits.

1. Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches.
2. Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing& gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.
3. Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.
4. Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.
5. Low Power Circuit's: Transistor and gate sizing, network restructuring and Reorganization. Special Flip Flops & Latches design, high capacitance nodes, low power digital cells library.
6. Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, precomputation logic.
7. Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components.
8. Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

BOOKS

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002
2. Rabaey, Pedram, "Low Power Design Methodologies" Kluwer Academic
3. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000
4. Yeo, "CMOS/BiCMOS ULSI Low Voltage Low Power" Pearson Education

Pre Ph.D. Course in Electronics and Communication Engineering

Advanced Data Communication

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CO1: Understand different modulation schemes and concepts of data communication.
CO 2: Understand various error detection and correction schemes, network topologies and protocols.
CO 3: Understand various types of switching, multiplexing and access techniques.
CO 4: Develop the complete understanding of the data communication and networking.

1. Digital Modulation: Introduction, Information Capacity Bits, Bit Rate, Baud, and M-ARY Coding, ASK, FSK, PSK, QAM, BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.
2.Basic Concepts of Data Communications, Interfaces and Modems: Data Communication Components, Networks, Distributed Processing, Network Criteria- Applications, Protocols and Standards, Standards Organizations- Regulatory Agencies, Line Configuration- Point-to-point Multipoint, Topology- Mesh- Star- Tree- Bus- Ring- Hybrid Topologies, Transmission Modes Simplex- Half duplex- Full Duplex, Categories of Networks- LAN, MAN, WAN and Internetworking, Digital Data Transmission- Parallel and Serial, DTE- DCE Interface- Data Terminal Equipment, Data Circuit- Terminating Equipment, Standards EIA 232 Interface, Other Interface Standards, Modems- Transmission Rates.
3. Error Detection and Correction: Types of Errors- Single- Bit Error, CRC (Cyclic Redundancy Check)- Performance, Checksum, Error Correction- Single-Bit Error Correction, Hamming Code. Data link Control: Stop and Wait, Sliding Window Protocols. Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocol-Binary Synchronous Communication (BSC) - BSC Frames- Data Transparency, Bit Oriented Protocols – HDLC, Link Access Protocols.
4. Switching: Circuit Switching- Space Division Switches- Time Division Switches- TDM Bus Space and Time Division Switching Combinations- Public Switched Telephone Network, Packet Switching, Circuit Switched Connection Versus Virtual Circuit Connection, Message Switching.
5. Multiplexing: Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing, Digital Hierarchy, Statistical Time Division Multiplexing. Multiple Access: Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Detection (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization- Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA). - Code - Division Multiple Access (CDMA).

BOOKS:
1. Data Communication and Computer Networking - B. A.Forouzan, 3rded., 2008, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5 ed., 2008, PEI.
3. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
4. Data and Computer Communications - William Stallings, 8thed., 2007, PHI.
5. Data Communication and Tele Processing Systems - T. Housely, 2ndEdition, 2008, BSP.
6. Data Communications and Computer Networks- Brijendra Singh, 2nded., 2005, PHI.
7. Telecommunication System Engineering – Roger L. Freeman, 4/ed., Wiley-Interscience, John Wiley & Sons, 2004.

Coding Theory and Techniques

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CO1: Design the channel performance using Information theory.

CO 2: Comprehend various error control code properties and apply linear block codes for error detection and correction.

CO 3: Apply convolution codes for performance analysis & cyclic codes for error detection and correction.

CO 4: Design BCH & RS codes for Channel performance improvement against burst errors.

1. Coding for Reliable Digital Transmission and storage: Mathematical model of Information. A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies. Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

2. Cyclic codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

3. Convolutional codes: Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

4. Burst –Error-Correcting codes: Decoding of Signle-Burst error Correcting Cyclic codes, Single-Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convoulutional Codes, Bounds on Burst Error-Correcting Capability, Interleaved Cyclic and Convolutional Codes , Phased-Burst –Error-Correcting Cyclic and Convolutional codes.

5. BCH code- Definition, Minimum distance and BCH Bounds, Decoding Procedure for BCH Codes- Syndrome Computation and Iterative Algorithms, Error Location Polynomials and Numbers for single and double error correction

TEXT BOOKS:

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc.

2. Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill Publishing.

3. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.

4. Information Theory, Coding and Cryptography – Ranjan Bose, 2ndEdition, 2009, TMH

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CO1: Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.
CO 2: Estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers.
CO 3: Describe the principles of optical sources and power launching-coupling methods.
CO 4: Compare the characteristics of fiber optic receivers and Design a fiber optic link based on budgets.

1. Signal propagation in Optical Fibers Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solitons.
2. Fiber Optic Components for Communication & Networking Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for Amplifiers, Optical Switches and Wavelength Converters.
3. Modulation and Demodulation Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.
4. Transmission System Engineering System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques.
5. Fiber Non-linearities and System Design Considerations Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.

BOOKS:
1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2 ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
3. Optical Fiber Communications – Gerd Keiser, 3 ed., 2000, McGraw Hill. REFERENCES:
4. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2 ed., 2000, PE.
5. Fiber Optics Communication – Harold Kolimbris, 2 ed., 2004, PEI
6. Optical Networks: Third Generation Transport Systems – Uyless Black, 2 ed., 2009, PEI
7. Optical Fiber Communications – Govind Agarwal, 2 ed., 2004, TMH.

Pre Ph.D. Course in Electronics and Communication Engineering
Optical Networks

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CO1: Recognize and evaluate the performance of various enabling technologies used in modern optical networks.

CO 2: Evaluate different WDM network topologies including broadcast-and-select and wavelength routing networks.

CO 3: Design virtual WDM network topologies.

CO 4: Analyze Photonic packet switching networks and time domain optical networking approaches.

1. Client Layers of Optical Networks SONET / SDH – Multiplexing, Frame Structure, Physical Layer, Infrastructure, ATM – Functions, Adaptation layers, QoS, Flow Control Signaling and Routing, IP – Routing, QoS, MPLS, Storage Area Networks – ESCON, Fiber Channel, HIPPI, Gigabit Ethernet.
2. WDM network Elements and Design Optical Line Terminals and Amplifiers, Add/Drop Multiplexers, Optical Cross Connects, Cost trade-offs in Network Design, LTD and RWA Problems, Dimensioning – Wavelength Routing Networks, Statistical and Maximum Load Dimensioning Models.
3. Network Control and Management Network Management Functions, Optical Layer Services and Interfacing, Layers within Optical Layer, Multivendor Interoperability, Performance and Fault Management, Configuration Management, Optical Safety.
4. Network Survivability Basic Concepts of Survivability, Protection in SONET/SDH Links and Rings, Protection in IP Networks, Optical Layer Protection – Service Classes, Protection Schemes, Interworking between Layers. Access Networks and Photonic Packet Switching Network Architecture, Enhanced HFC, FTTC, Photonic Packet Switching – OTDM, Synchronization, Header Processing, Buffering, Burst Switching, Test Beds.

BOOKS:

1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2 ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2. WDM Optical Networks: Concepts, Design and Algorithms – C. Siva Rama Murthy and Mohan Guruswamy 2 ed., 2003, PEI.
3. Optical Networks: Third Generation Transport Systems – Uyless Black, 2 ed., 2009, PEI.
4. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2 ed., 2000, PE.
5. Fiber Optics Communication – Harold Kolimbris, 2 ed., 2004, PEI.
6. Networks – Timothy S. Ramteke, 2 ed., 2004, PEI.
7. Optical Fiber Communications – Govind Agarwal, 2 ed., 2004, TMH.

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering

Internetworking

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CO 1: To develop an understanding of computer networking basics.
CO 2: To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
CO 3: Internetworking architectural infrastructure in application.

1. Internetworking concepts: Principles of Internetworking, Connectionless Internetworking, Application level Interconnections, Network level Interconnection, Properties of the Internet, Internet Architecture, Wired LANS, Wireless LANs, Point-to-Point WANs, Switched WANs, Connecting Devices, TCP/IP Protocol Suite. IP Address: Classful Addressing: Introduction, Classful Addressing, Other Issues, Sub-netting and Super-netting IP Address: Classless Addressing: - Variable length Blocks, Sub-netting, Address Allocation. Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router. ARP and RARP:ARP, ARP Package, RARP.
2. Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum, IP V.6. Transmission Control Protocol (TCP): TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times. Stream Control Transmission Protocol (SCTP): SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control. Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP. Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/ Time Out Freezing, Selective Retransmission, Transaction Oriented TCP.
3. Unicast Routing Protocols (RIP, OSPF, and BGP: Intra and Inter-domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP. Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.
4. Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet. Remote Login TELNET:- Concept, Network Virtual Terminal (NVT). File Transfer FTP and TFTP: File Transfer Protocol (FTP). Electronic Mail: SMTP and POP. Network Management-SNMP: Concept, Management Components. World Wide Web- HTTP Architecture. Multimedia: Digitizing Audio and Video, Network security, security in the internet firewalls. Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Network Security, Security in the Internet, Firewalls.

BOOKS:

1. TCP/IP Protocol Suite- Behrouz A. Forouzan, Third Edition, TMH
2. Internetworking with TCP/IP Comer 3 rd edition PHI
3. High performance TCP/IP Networking- Mahbub Hassan, Raj Jain, PHI, 2005
4. Data Communications & Networking – B.A. Forouzan – 2ndEdition – TMH
5. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Micro Electromechanical Systems

L	T	P
4	0	0

CO1: Students will explain MEMS Technology, Present, Future and Challenges.
CO 2: Students will be able to explain micro sensors, micro-actuators, their types and applications.
CO 3: Students will be able to explain about fabrication processes for producing micro-sensors and actuators. They will also be able to apply Reliability, and Failure Analysis Testing.

1. Introduction, basic structures of MEM devices – (Canti-Levers, Fixed Beams diaphragms). Broad Response of Micro electromechanical systems (MEMS) to Mechanical (Force, pressure etc.) Thermal, Electrical, optical and magnetic stimuli, compatibility of MEMS from the point of power dissipation, leakage etc.
2. Review of mechanical concepts like stress, strain, bending moment, deflection curve. Differential equations describing the deflection under concentrated force, distributed force, distributed force, deflection curves for canti-levers- fixed beam. Electrostatic excitation – columbic force between the fixed and moving electrodes. Deflection with voltage in C.L. Deflection Vs Voltage curve, critical fringe field – field calculations using Laplace equation. Discussion on the approximate solutions – transient response of the MEMS.
3. Two terminal MEMS - capacitance Vs voltage Curve – variable capacitor. Applications of variable capacitors. Two terminal MEM structures. Three terminal MEM structures – controlled variable capacitors – MEM as a switch and possible applications.
4. MEM circuits & structures for simple GATES- AND, OR, NAND, NOR, Exclusive OR<simple MEM configurations for flip-flops triggering applications to counters, converters. Applications for analog circuits like frequency converters, wave shaping. RF Switches for modulation. MEM Transducers for pressure, force temperature. Optical MEMS.
5. MEM Technologies: Silicon based MEMS- process flow – brief account of various processes and layers like fixed layer, moving layers spacers etc., and etching technologies. Metal Based MEMS: Thin and thick film technologies for MEMS. Process flow and description of the processes. Status of MEMS in the current electronics scenario.

BOOKS:

1. MEMS Theory, Design and Technology - GABRIEL. M.Review, R.F.,2003, John wiley & Sons.
2. Strength of Materials –Thimo Shenko, 2000, CBS publishers & Distributors.
3. MEMS and NEMS, Systems Devices; and Structures - Servey E.Lyshevski, 2002, CRC Press.
4. Sensor Technology and Devices - Ristic L. (Ed), 1994, Artech House, London

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Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Network Security and Cryptography

L	T	P
4	0	0

CO1: To understand basics of Cryptography and Network Security.
CO 2: To be able to secure a message over insecure channel by various means.
CO 3: To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
CO 4: To understand various protocols for network security to protect against the threats in the networks.

1. Introduction: Attacks, Services and Mechanisms, Security attacks, Security services. A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.
2. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. Conventional Encryption:Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography:Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.
3. Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms. Message authentication and Hash functions:Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.
4. Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, X.509 directory Authentication service.Electronic Mail Security: Pretty Good Privacy. S/MIME.
5. IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms : Intruders, Viruses and Related threats. Fire Walls : Fire wall Design Principles, Trusted systems.

BOOK:

1. Cryptography and Network Security: Principles and Practice - William Stallings, 2000, PE.
2. Principles of Network and Systems Administration, Mark Burgess,John Wielly.

Inter Disciplinary course

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Pre Ph.D. Course in Electronics and Communication Engineering
Adhoc Wireless and Sensor Networks

L	T	P
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CO1: Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks.
CO 2: Describe the MAC protocol issues of ad hoc networks and describe routing protocols for ad hoc wireless networks with respect to TCP design issues.
CO 3: Explain the concepts of network architecture and MAC layer protocol for WSN.
CO4: Discuss the WSN routing issues by considering QoS measurements.

1. Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standard, HIPERLAN Standard, Bluetooth, Home RF. Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web Over Wireless.
2. AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet. MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.
3. ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols. Transport layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.
4. QUALITY OF SERVICE: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. ENERGY MANAGEMENT: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.
5. WIRELESS SENSOR NETWORKS: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

BOOKS: 1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control Jagannathan Sarangapani, CRC Press.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Mobile Computing Technologies

L	T	P
4	0	0

CO1: Define mobile technologies in terms of hardware, software, and communications.
CO2: Utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.
CO3: Evaluate the effectiveness of different mobile computing frameworks.

1. Introduction to Mobile Computing Architecture Mobile Computing – Middleware and Gateways – Application and Services – Developing Mobile Computing Applications – Security in Mobile Computing – Architecture for Mobile Computing – Three Tier Architecture – Design considerations for Mobile Computing – Mobile Computing through Internet – Making existing Applications Mobile Enabled. Cellular Technologies: GSM, GPS, GPRS, CDMA and 3G Bluetooth – Radio Frequency Identification – Wireless Broadband – Mobile IP – Internet Protocol Version 6 (IPv6) – Java Card – GSM Architecture – GSM Entities – Call Routing in GSM – PLMN Interfaces – GSM addresses and Identifiers – Network aspects in GSM – Authentication and Security – Mobile computing over SMS – GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data Services in GPRS – Applications for GPRS – Limitations of GPRS.
2. Wireless Application Protocol (WAP) and Wireless LAN WAP – MMS – Wireless LAN Advantages – IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in wireless LAN Intelligent Networks and Interworking Introduction – Fundamentals of Call processing – Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) – softswitch – Programmable Networks – Technologies and Interfaces for IN
3. Client Programming, Palm OS, Symbian OS, Win CE Architecture Introduction – Moving beyond the Desktop – A Peek under the Hood: Hardware Overview – Mobile phones – PDA – Design Constraints in Applications for Handheld Devices – Palm OS architecture – Application Development – Multimedia – Symbian OS Architecture – Applications for Symbian, Different flavors of Windows CE -Windows CE Architecture J2ME JAVA in the Handset – The Three-prong approach to JAVA Everywhere – JAVA 2 Micro Edition (J2ME) technology – Programming for CLDC – GUI in MIDP – UI Design Issues – Multimedia – Record Management System
4. Voice over Internet Protocol and Convergence Voice over IP- H.323 Framework for Voice over IP – Session Initiation Protocol – Comparision between H.323 and SIP – Real Time protocols – Convergence Technologies – Call Routing – Voice over IP Applications – IP multimedia subsystem (IMS) – Mobile VoIP Security Issues in Mobile Computing Introduction – Information Security – Security Techniques and Algorithms – Security Protocols – Public Key Infrastructure – Trust – Security Models – Security frameworks for Mobile Environment

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BOOKS: 1. Mobile Computing – Technology, Applications and Service Creation – Asoke K Talukder, Roopa R Yavagal, 2009, TATA McGraw Hill
2. Mobile Communications – Jochen Schiller – 2nd Edition – Pearson Education
3. The CDMA 2000 System for Mobile Communications – Vieri Vaughi, Alexander Damn Jaonvic – Pearson
4. ADALESTEIN : Fundamentals of Mobile & Parvasive Computing, 2008, TMH.

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Data Warehousing and Data Mining

L	T	P
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CO1: Be familiar with mathematical foundations of data mining tools.
CO2: Understand and implement classical models and algorithms in data warehouses and data minin.
CO3: Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
CO4: Master data mining techniques in various applications like social, scientific and environmental context.
CO5: Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

1. Introduction: Introduction to RDBMS, Data Warehouse, Transactional Databases, Data Mining Functionalities, Interestingness of pattern, classification of data mining system, major issues
2. Data Warehouse and OLAP: Difference from traditional databases, Multidimensional data model, Schema for Multi dimensional model, measures, concept hierarchies, OLAP operations, starnet query model, Data Warehouse architecture, ROLAP, MOLAP, HOLAP, Data Warehouse Implementation, Data Cube, Metadata Repositories, OLAM
3. Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept hierarchy generation
4. Data Mining Architecture: Data Mining primitives, Task relevant data, interestingness measures, presentation and visualization of patterns, Data Mining Architecture, Concept Description, Data Generalization and Summarization, Attributed oriented induction, Analytical characterization, Mining class comparisons,
5. Association Rules: Association rules mining, Mining Association rules from single level, multilevel transaction databases, multi dimensional relational databases and data warehouses, Correlational analysis, Constraint based association mining
6. Classification and Clustering: Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, Types of data in clustering, categorization of clustering methods

Books:
1. Data Mining: Concepts and Techniques By J.Han and M. Kamber By Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition

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2. Data Mining Introductory and Advance Topics By Dunham, Pearson Education, Latest Edition

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Neural Networks and Fuzzy Logic

L	T	P
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CO1: Comprehend the concepts of feed forward neural networks.
CO2: Analyze the various feedback networks.
CO3: Understand the concept of fuzziness involved in various systems and fuzzy set theory.
CO4: Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
CO5: Analyze the application of fuzzy logic control to real time systems.

1. Fundamentals of Neural Networks: Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN - Classification, Clustering, Pattern Recognition, Function Approximation. Basic approach of the working of ANN – Training, Learning and Generalization.
2. Supervised Learning: Single-layer Networks, Linear Separability, handling linearly non-separable sets. Training algorithm. Error correction & gradient decent rules. Multi-layer network- Architecture, Back Propagation Algorithm (BPA) – Various parameters and their selection, Applications, Feedforward Network, Radial- Basis Function (RBF) network & its learning strategies.
3. Unsupervised Learning: Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen's, Self-organizing Maps.
Neurodynamical models: Stability of Equilibrium states, Hopfield Network, Brain-state-in-aBox network, Bidirectional associative memories.
4. Fuzzy Logic: Basic concepts of Fuzzy Logic, Fuzzy vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic.

Books:
1. Satish Kumar,"Neural Network : A classroom approach".
2. Jacek M.Zurada," Artificial Neural Networks".
3. Simon Haykin," Artifical Neural Network".
4. Rajasekaran & Pai,"Neural networks, Fuzzy logic and genetic algorithms".
5. Hagan, Demuth & Beale,"Neural Network Design.".
6. T. J. Ross," Fuzzy logic with engineering applications"

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering

Mathematical Foundations of Computer Networks

L	T	P
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Course Outcomes:

CO1. Know how to represent various statements using quantifiers, relations, functions, permutations and combinations, groups, graphs and trees.

CO2. Use logical notations to formulate and reason about fundamental mathematical concepts such as sets, relations, functions and algebraic structures.

CO3. Analyse the growth of functions and real world problems using various concepts like recurrence relations, graph coloring, etc.

CO4. Apply mathematical logic to solve problems, pigeonhole principle to solve real time problems.

CO5. Model and solve real world problems using graphs and trees.

1. Basic algorithms on directed graphs, weighted shortest paths.

2. Networks and routing algebras - fixed-point equations, sequential algorithm to solve the fixed-point equations, generalized distance-vector and link-state routing protocols.

3. Applications to quality-of service intra-domain routing and to policy-based inter-domain routing in the Internet.

4. Network flows - flows and residual networks, Max-flow Min-cut theorem, Ford Fulkerson method and Edmonds-Karp algorithm.

5. Network calculus- Min-plus calculus: integrals and convolutions, Arrival curves and token buckets; service curves and schedulers, Applications to integrated and differentiated services in the Internet.

Books:

1. Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein. Introduction to algorithms, 2th edition. The MIT Press 2001 [Chapter VI]

2. Jorgen Bang-Jensen and Gregory Gutin. Digraphs: theory, algorithms and applications. Springer, 2002 [Section 7.3 and 9.5]

3. J. L. Sobrinho, An algebraic theory of dynamic network routing, IEEE/ACM Transactions on Networking, 13(5), October 2005.

4. Jean-Yves Le Boudec and Patrick Thiran. Network calculus. Springer, 2006. [Chapter 1, 2, and 3]

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering

Sensors For Ranging and Imaging

L T P
4 0 0

1. Introduction to sensing Introduction, brief history of sensing, Passive infrared sensing, sensor systems, frequency band allocations for the electromagnetic spectrum, acoustic spectrum

2. Active Ranging and Imaging Sensors Overview, Pulsed Time-of-Flight Operation, Pulsed Range Measurement, Other Methods to Measure Range, the Radar Range Equation, The Acoustic Range Equation, Range Measurement Radar for a Cruise Imaging Techniques, Range –Gate limited 2D Image Construction, Beam width limited 3D Image Construction, The Lidar Range Equation, Lidar System Performance, Digital Terrain Models, Airborne Lidar Hydrography, 3D Imaging, Acoustic Imaging, Lidar Locust Tracker

3. Target and Clutter Characteristics Introduction, Target cross –section, Radar cross-sections(RCS),RCS of Simple shapes, Radar cross section of complex Targets , Effect of Target, RCS of living creatures, fluctuations in Radar Cross-section, Radar Stealth, Target cross section in Infrared, Acoustic Target Crosssection, clutter, Orepass Radar Development, Detecting Targets in clutter, Target Detection with Air Surveillance Radar

4. Tracking Moving Targets Tracking While Scan, The Coherent Pulsed Tracking Radar, Range-Gated Pulsed Doppler Tracking, Coordinate Frames, Antenna Mounts and servo systems, On-Axis Tracking, Tracking in Cartesian Space, fire Control Radar

5. Radio Frequency Identification Tags and Transponders Principles of Operation, History, Secondary Surveillance Radar, RFID Systems, other Applications, Technical Challenges, Harmonic Radar

Book

1. Introduction to Sensors for Ranging and Imaging, Dr.Graham Brooker, Yes Dee Publishing Pvt. Ltd ,2012.
2. Introduction to Remote sensing , James B Campbell, Third Edition, Taylor and Francis
3. Principles of Remote sensing, ITC Educational Text Book Series 2
4. Introduction to sensor systems,Shahen A. Hovanessian
5. Space Mission Analysis and Design James R. Wertz,Wiley J. Larson, 1999