# IKG Punjab Technical University

## Syllabus  (3<sup>rd</sup>- 8<sup>th</sup> Semester)

## for

## Undergraduate Degree Programme



## Bachelor of Technology

## ELECTRONICS AND COMMUNICATION ENGINEERING

## Scheme & Syllabus

## 2019 and onwards

**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.*

## 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.

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.

| Sr. No. | Course code | Course Title | L | T | P | Hrs | Internal Marks | External Marks | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| Semester III [Second year] |
| Branch/Course: Electronics and Communication Engineering |
| 1 | UC-BTEC-301-18 | Electronic Devices | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3 |
| 2 | UC-BTEC-302-18 | Digital System Design | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 4 |
| 3 | UC-BTEC-303-18 | Electromagnetic Waves | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 4 |
| 4 | UC-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 | UC-BTEC-311-18 | Electronic Devices Laboratory | 0 | 0 | 2 | 2 | 30 | 20 | 50 | 1 |
| 7 | UC-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 | UC-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 | colspan2 Satisfactory/Un-satisfactory | | Non-credit |
| | | **Total** | **18** | **4** | **10** | **32** | **360** | **440** | **800** | **24** |

| Sr. No. | Course code | Course Title | L | T | P | Hrs | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| Semester IV [Second year] |
| Branch/Course: Electronics and Communication Engineering |
| 1 | UC-BTEC-401-18 | Analog Circuits | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 4 |
| 2 | UC-BTEC-402-18 | Microprocessors and Microcontrollers | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 4 |
| 3 | BTCS-301-18 | Data Structures & Algorithms | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3 |
| 4 | UC-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 | UC-BTEC-411-18 | Analog Circuits Laboratory | 0 | 0 | 2 | 2 | 30 | 20 | 50 | 1 |
| 8 | UC-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 | | colspan2 Satisfactory/Un-satisfactory | | Non-credit |
| | | **Total** | **18** | **3** | **6** | **27** | **360** | **340** | **700** | **20** |

| Sr. No. | Course code | Course Title | L | T | P | Hrs. | Internal Marks | External Marks | Total | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| **Semester V [Third year]** |
| **Branch/Course: Electronics and Communication Engineering** |
| 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-90XX-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 | UC-BTEC-10X-18 | Professional Elective-1 Lab (Optional) | 0 | 0 | 2 | 2 | \multicolumn{3}{c}{Satisfactory/Un-satisfactory} | Non-credit |
| 12 | BMPD-351-18 | Mentoring and Professional Development | 0 | 0 | 2 | 2 | \multicolumn{3}{c}{Satisfactory/Un-satisfactory} | Non-credit |
| | | **Total** | 18 | 3 | 16 | 37 | 390 | 460 | 850 | 24 |

| Sr. No. | Course code | Course Title | L | T | P | Hrs | Internal Marks | External Marks | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| **Semester VI [Third year]** |
| **Branch/Course: B.Tech. Electronics and Communication Engineering** |
| 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-90YY-18 | Professional Elective-2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3 |
| 6 | 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-BTEC-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 | 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 | UC-BTEC-907X-18 | Professional Elective-3 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3 |
| 2 | UC-BTEC-908X-18 | Professional Elective-4 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3 |
| 3 | UC-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 | UC-BTEC-731-18 | Project-II & Report | 0 | 0 | 12 | 12 | 120 | 80 | 200 | 6 |
| 9 | UC-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** |

| Semester VII/VIII [Fourth year] | | | | | | |
|---|---|---|---|---|---|---|
| **B.Tech. Electronics and Communication Engineering** | | | | | | |
| Sr. No. | Course code | Course Title | Internal Marks | External Marks | Total | Credits |
| 1 | UC-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:

| Sr. No. | Course Code | Course Title | L | T | P | Hr | Int Marks | Ext Marks | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| Semester VII/VIII [Fourth year] | | | | | | | | | |
| | Branch/Course: Electronics and Communication Engineering | | | | | | | | | |
| 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 | 4 | 4 | 60 | 40 | 100 | 4 |
| 6 | BMPD-381-18 | Mentoring and Professional Development | 0 | 0 | 2 | 2 | Satisfactory/Un-satisfactory | | | Non-credit |
| | | Total | 12 | 0 | 6 | 18 | 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.

**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 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.

# IK Gujral Punjab Technical University Kapurthala

**Subjects for Minor Degree in B.Tech Electronics and Communication Engineering (ECE)**

**Core Subjects:**

| S.No. | Subject Code | Course Title | Credits |
|-------|-------------|--------------|---------|
| 1. | UC-BTEC-305-18 | Basic Electronics | 3 |
| 2. | UC-BTEC-306-18 | Digital Electronics | 3 |
| 3. | UC-BTEC-401-18 | Analog Circuits | 4 |
| 4. | UC-BTEC-402-18 | Microprocessors and Microcontrollers | 4 |
| 5. | UC-BTEC-403-18 | Signals and Systems | 4 |
| 6. | UC-BTEC-502-18 | Digital Signal processing | 4 |
| 7. | UC-BTEC-501-18 | Analog and Digital Communication | 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. | UC-BTEC-301-18 | Electronic Devices | 3 |
| 2. | UC-BTEC-303-18 | Electromagnetic Waves | 4 |
| 3. | BTEC-908B-18 | Mobile Communication & Networks | 3 |
| 4. | UC-BTEC-906B-18 | Satellite Communication | 3 |
| 5. | BTEC-909A-18 | Introduction to Big Data | 3 |
| 6. | BTEC-908A-18 | Artificial Intelligence | 3 |
| 7. | BTEC-907A-18 | Internet of Things (IoT) & Cloud Computing | 3 |
| 8. | BTEC-907C-18 | Robotics and Embedded systems | 3 |
| 9. | BTEC-908C-18 | VLSI Design | 3 |
| 10. | BTEC-908D-18 | Soft Computing | 3 |
| 11. | BTEC-909D-18 | Artificial Intelligence & Machine learning | 3 |
| 12. | BTEC-907E-18 | Adaptive Signal Processing | 3 |
| 13. | BTEC-908E-18 | Digital Image and Video Processing | 3 |

**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 (2019 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 | 1 | 5 | PE-1 | UC-BTEC-901C-19 | Satellite Communication | 3:0:0 | 3 |
| | 2 | 6 | PE-2 | UC-BTEC-902C-19 | Mobile Adhoc Networks | 3:0:0 | 3 |
| | 3 | 7 | PE-3 | BTEC-907B-18 | Antenna Radiating Systems | 3:0:0 | 3 |
| | 4 | 7 | PE-4 | BTEC-908A-18 | Artificial Intelligence | 3:0:0 | 3 |
| | 5 | 7 | PE-4 | BTEC-908F-19 | Wireless Sensor Networks | 3:0:0 | 3 |
| | 6 | 7 | PE-5 | BTEC-908D-18 | Information Theory and Coding | 3:0:0 | 3 |
| | 7 | 7 | PE-5 | BTEC-909D-18 | Artificial Intelligence & Machine Learning | 3:0:0 | 3 |
| Software Group | 1 | 5 | PE-1 | UC-BTEC-901E-19 | Fuzzy Logic Systems | 3:0:0 | 3 |
| | 2 | 5 | PE-1 | UC-BTEC-901F-19 | JAVA Programing | 3:0:0 | 3 |
| | 3 | 6 | PE-2 | UC-BTEC-902E-19 | Artificial Neural Networks | 3:0:0 | 3 |
| | 4 | 7 | PE-3 | BTEC-907D-18 | Python Programming | 3:0:0 | 3 |
| | 5 | 7 | PE-3 | BTEC-908D-18 | Soft Computing | 3:0:0 | 3 |
| | 6 | 7 | PE-4 | BTEC-907E-18 | Adaptive Signal processing | 3:0:0 | 3 |
| | 7 | 7 | PE-4 | BTEC-909A-18 | Introduction to Big Data | 3:0:0 | 3 |
| | 8 | 7 | PE-5 | BTEC-908E-18 | Digital Image & Video Processing | 3:0:0 | 3 |

**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. | UC-BTEC-301-18 | Odd | Electronic Devices | 3 | 0 | 0 | 3 | 3 |
| 2. | UC-BTEC-601-18 | Even | Wireless Communication | 3 | 0 | 0 | 3 | 3 |
| 3. | UC-BTEC-901A-18 | Odd | AC & DC Mototrs | 3 | 0 | 0 | 3 | 3 |
| 4. | UC-BTEC-902A-18 | Even | Power Electronics | 3 | 0 | 0 | 3 | 3 |
| 5. | UC-BTEC-906B-18 | Odd | Satellite Communication | 3 | 0 | 0 | 3 | 3 |
| 6. | UC-BTEC-902C-18 | Even | Mobile Adhoc Networks | 3 | 0 | 0 | 3 | 3 |
| 7. | BTEC-907B-18 | Odd | Antenna Radiating Systems | 3 | 0 | 0 | 3 | 3 |
| 8. | BTEC-907C-18 | Odd | Robotics and Embedded systems | 3 | 0 | 0 | 3 | 3 |
| 9. | BTEC-908A-18 | Odd | Artificial Intelligence | 3 | 0 | 0 | 3 | 3 |
| 10. | BTEC-909A-18 | Odd | Introduction to Big Data | 3 | 0 | 0 | 3 | 3 |
| 11. | BTEC-908B-18 | Odd | Mobile Communication and Networks | 3 | 0 | 0 | 3 | 3 |
| 12. | BTEC-909B-18 | Odd | Information Theory and Coding | 3 | 0 | 0 | 3 | 3 |
| 13. | BTEC-908C-18 | Odd | VLSI Design | 3 | 0 | 0 | 3 | 3 |
| 14. | BTEC-909C-18 | Odd | Embedded System Design | 3 | 0 | 0 | 3 | 3 |
| 15. | BTEC-909D-18 | Odd | AI & Machine Learning | 3 | 0 | 0 | 3 | 3 |
| 16. | BTEC-908D-18 | Odd | Soft Computing | 3 | 0 | 0 | 3 | 3 |

## 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 |
| 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 |

# THIRD SEMESTER

## B. Tech.

## Electronics & Communication Engineering



## Syllabus

# I K Gujral Punjab Technical University

## Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

| UC-BTEC-301-19 | 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 circuit 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.

## Unit 2: Diodes

Generation and recombination of carriers; Poisson and continuity equation p-n junction characteristics; V-I characteristics; equivalent circuit models; avalanche breakdown; Zener diode; Schottky diode; light emitting diode; tunnel diode; varactor diode, solar cell, Rectifier 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.

| UC-BTEC-302-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **Digital System Design** | 4 | 3 | 1 | 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.

## Unit 1- Number System and Binary Code

Introduction, Binary, Octal and Hexadecimal Number System, Conversion, Addition & Subtractions in number system. Signed and unsigned numbers, 1's and 2's compliment, ASCII code, Excess-3 code, Gray code, BCD code. Gates: AND, OR, NOT, NOR, NAND, EX-OR, EX-NOR, Basic theorem of Boolean Algebra, Sum of Products and Product of Sums, canonical form, Minimization of logic function, Minimization using K-map and Q-M method.

## Unit 2- Combinational Circuits

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

## Unit 3- Sequential Circuits

Flip flops, Clocked flip flops, SR, JK, D, T and edge triggered flip flops. Excitation tables of Flip flops. Shift Registers, Type of Shift Registers, Counter, Counter types, counter design with state equation and state diagrams. Logic families: RTL, ECL and CMOS.

## Unit 4- D/A and A/D Converters & Semiconductor Memories

D/A convertors:  Weighted register D/A converter, binary ladder D/A converter, 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.  Memory organization, classification and characteristics of memories, Sequential memories, ROMs, R/W memories, PLA and PAL. Introduction to VHDL

## Recommended Books

1. R.P. Jain, Modern digital Electronics, Tata McGraw Hill
2. A Anand Kumar, Fundamentals Of Digital Circuits, PHI, 2003
3. W.H. Gothmann, Digital Electronics-An introduction to theory and practice, PHI
4. Morris Mano, Digital Design, Prentice Hall of India Pvt. Ltd
5. Bhaskar, A VHDL Primer, Prentice Hall

| UC-BTEC-303-19 | 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, Reflection coefficient and VSWR; Loss-less and Low-loss 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; Co-ordinate system: Rectangular, Circular and Spherical Co-ordinate systems, Basic laws of Electromagnetics, Maxwell's equations and their interpretation, 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; Poynting vector; 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, Surface currents on the waveguide walls, Attenuation in waveguide.

## Recommended Books

1. RK Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India 2nd Edition, 2005.
2. EC Jordan & KG Balmain, Electromagnetic waves & Radiating Systems, PHI 2nd Edition, 1964.
3. NN Rao, Fundamentals of Engineering Electromagnetics, Prentice Hall 1972.
4. DK Cheng Field & Wave Electromagnetics, Prentice Hall 1989.

| UC-BTEC-304-19 | 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).

## 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.

| UC-BTEC-311-19 | 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 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/MOSFET 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

| UC-BTEC-312-19 | 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

| 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

| UC-BTEC-321-19 | 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.

| 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.

# FOURTH SEMESTER

## B. Tech.

## Electronics & Communication Engineering



## Syllabus

# I K Gujral Punjab Technical University

## Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

| UC-BTEC-401-19 | 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

| UC-BTEC-402-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **Microprocessors and Microcontrollers** | 4 | 3 | 1 | 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

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

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.

| UC-BTEC-403-19 | 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.

| 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).

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.

| UC-BTEC-411-19 | 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 Output waveforms of diode clipper and Diode Clamper circuits.
2. To study the Input/Output V-I characteristics of BJT in CE configuration.
3. To study Emitter follower circuit.
4. To calculate the frequency of RC phase shift oscillator.
5. To measure the frequency of Wein bridge oscillator.
6. To measure the frequency of Hartley oscillator.
7. To measure the frequency of Colpitt's oscillator.
8. To study Gain analysis of Class-A Power Amplifier
9. To study Gain analysis of Class-B Power Amplifier
10. To study Gain analysis of Class B Push-pull 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

| UC-BTEC-412-19 | 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

| 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.

# FIFTH SEMESTER

## B. Tech.
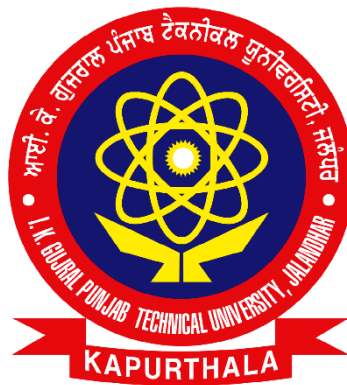
## Electronics & Communication Engineering



## Syllabus

# I K Gujral Punjab Technical University

## Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

| UC-BTEC-501-19 | 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.

| UC-BTEC-502-19 | 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.

| UC-BTEC-503-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **Linear Integrated Circuits** | 4 | 3 | 1 | 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-504-19 | 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.

| BTMS-YYY18 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **Project Management** | 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.

| UC-BTEC-901A-19 | 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.

| UC-BTEC-901C-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **SATELLITE COMMUNICATION** | 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.

| UC-BTEC-901E-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **FUZZY LOGIC SYSTEMS** | 3 | 3 | 0 | 0 | 40 | 60 |

# Course Objectives

The Objective is to develop the skills to gain a basic understanding on fuzzy logic theory and neural networks and use these for controlling real time systems.

# Course Outcomes

After undergoing this course, students will be able to

I. Understand the learning and working of basic artificial neural models and their network topologies.
II. Get exposure of feed forward neural networks.
III. Gain knowledge about basic learning laws of various neural models.
IV. Learn the basic concepts and working of fuzzy Logic sets and components to develop and implement a basic trainable neural network or a fuzzy logic system for any application.

# Unit-I: Introduction to Neural Networks

Introduction, Humans and computers, Organization of the brain, Biological neuron, Difference between biological and artificial neuron models, Characteristics of ANN, Historical developments, Potential applications of ANN, Different artificial neuron models, Operations of artificial neuron, Types of neuron activation function, ANN architectures, Classification taxonomy of ANN, Connectivity, Neural dynamics (Activation and synaptic), Network topologies, Learning strategy (Supervised, unsupervised, reinforcement), Learning rules.

# Unit–II: Single Layer and Multilayer Feed- Forward Neural Networks

Perception models: Discrete, continuous and multi-Category, Training algorithms: Discrete and continuous perception networks, Perception convergence theorem, Limitations of the perception model, Applications. Credit assignment problem, Generalized delta rule, Derivation of back propagation (BP) training, Summary of back propagation algorithm, Kolmogorov theorem, Learning difficulties and improvements.

# Unit-III: Fuzzy Sets and Components

Classical sets, Operations and relations, Fuzzy sets and its properties, Fuzzy relations, Membership functions, Fuzzification, Development of rule base and decision making system, De-fuzzification and its techniques, Fuzzy logic system: Block diagram, Implementation, Fuzzy logic controller Vs PID controller.

# Unit –IV: Application of Fuzzy Logic Control

Inverted pendulum, Image processing, Home-heating system, Blood pressure during anesthesia, Introduction to neuro-fuzzy controller, Antilock Braking System (ABS).

# Recommended Text and Reference Books

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley publications.
2. Yegnanarayanan, Artificial Neural Networks, Prentice Hall of India Pvt. Ltd.
3. Bart Kosko, Neural Networks & Fuzzy Logic, Prentice Hall.
4. Simon S. Haykin, Neural Networks, Prentice Hall.

| UC-BTEC-901F-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **JAVA Programming** | 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:
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-511-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **Analog and Digital Communication Laboratory** | 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.

| UC-BTEC-512-19 | 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)

| UC-BTEC-513-19 | 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.

| UC-BTEC-521-19 | 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.

# SIXTH SEMESTER

# B.Tech.

# Electronics & Communication Engineering (ECE)



## Syllabus

# I K Gujral Punjab Technical University

## Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

| 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.

**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.

| 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.

**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.
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.

**Unit 3: Antennas:** Concept of Radiation in Single wire, Two wire, Dipole: Infinitesimal dipole, Short dipole Monopole and half wave dipole; Introduction to Antenna parameters: Reflection Co-efficient, VSWR, Radiation pattern, Directivity, Gain; Far-field, Radiating near-field and reactive near-field regions; 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

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

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 | Cred its | 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:
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

| 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.

## 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 Components.
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.

| 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.

# SEVENTH/EIGHTH SEMESTER

## B.Tech.

## Electronics & Communication Engineering (ECE)



## Syllabus

# IKGujral Punjab Technical University

## Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

# 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.

**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 |
|---|---|---|---|---|---|---|
| <mark>Robotics and Embedded Systems</mark> | 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

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.

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.

**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-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.
- 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-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

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
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.

## 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.

| 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.

| BTEC-908F-19 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **Wireless Sensor Networks** | 3 | 3 | 0 | 0 | 40 | 60 |

## Course Objective

To enable students, familiarize with Wireless 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 Node Structure:** Introduction: Sensing and Processor Subsystems, Architectural Overview, 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.

**Unit III Physical Layer:** Introduction to 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, Two-State Markov Error Model, Sensing Models: Binary and Probabilistic Sensing Models.

**Unit IV WSN Protocols and Technologies:** MAC protocols, Issues in designing routing protocols, Classification of routing protocols, Flat routing, Flooding and gossiping, SPIN protocol, Directed diffusion protocol, Rumour routing, Location-based routing protocols.

WSN application to ZigBee technology, Ultrawide bandwidth technology, Bluetooth technology, Comparison among technologies

**Unit V Applications of WSNs:** Entertainment and Consumer Electronics, Logistics, Transportation, Industrial Control and Monitoring, Home Automation, Security and Military Sensing, Intelligent Agriculture and Environmental monitoring, Health Monitoring.

## Recommended Books

- Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley Inter Science 2017
- Edgar H. Callaway, Wireless Sensor Networks: Architectures and Protocols, Jr. Auerbach Publications, CRC Press 2016
- C. S Raghavendra, Krishna M, Sivalingam, Taieb Znati, Wireless Sensor Networks, Springer 2011
- Bhaskar Krismachari, Networking Wireless Sensors, Cambridge University Press 2005
- Victor Lesser, Charles L. Ortiz, Milind Tambe, Distributed Sensor Networks: A Multiagent Perspective, Kluwer Publications 2009
- T.S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education Asia, 2010.

| 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-909D-18 | Credits | L | T | P | Int | Ext |
|---|---|---|---|---|---|---|
| **Artificial Intelligence & Machine Learning** | 3 | 3 | 0 | 0 | 40 | 60 |

## 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-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 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

**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 |
|---|---|---|---|---|---|---|
| **Introduction to Big Data** | 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.

**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.2$^{nd}$ 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 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
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

| UC-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

## 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.