IKG Punjab Technical University

Syllabus (3rd-8th Semester)

for

Undergraduate Degree Programme

Bachelor of Technology

ELECTRONICS AND INSTRUMENTATION ENGINEERING

Scheme & Syllabus

2023 & onwards

18/05/2021

Structure of Distribution of credits Electronics & Instrumentation 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 relevent 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.*

Semester III [Second year]										
Branch/Course: Electronics and Instrumentation Engineering										
Sr. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**Hrs**	**Internal Marks**	**External Marks**	**Total**	**Credits**
1	BTEC- 301-18	Electronic Devices	3	0	0	3	40	60	100	3
2	BTEI-301-18	Electronic Measurements and Instrumentation	3	1	0	4	40	60	100	4
3	BTEC- 303-18	Electromagnetic Waves	3	1	0	4	40	60	100	4
4	BTEC-304-18	Network Theory	3	1	0	4	40	60	100	4
5	BTAM 303-23	Mathematics III (Integral Transforms, Probability & Statistics)	4	1	0	4	40	60	100	4
6	BTEC-311-18	Electronic Devices Laboratory	0	0	2	2	30	20	50	1
7	BTEI-311-18	Electronic Measurements and Instrumentation Laboratory	0	0	2	2	30	20	50	1
8	HSMC101-18 /HSMC102-18*	Foundational Course in Humanities (Development of Societies/Philosophy)	3	0	0	3	40	60	100	3
9	BTEI-321-18	4-Week Institutional Training	0	0	4	4	60	40	100	Non-credit
10	BMPD-331-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit
		Total	**19**	**4**	**10**	**29**	**360**	**440**	**800**	**24**

Semester IV [Second year]										
Branch/Course: Electronics and Instrumentation Engineering										
Sr. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**Hrs**	**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
1	BTEI-401-18	Transducers and Signal Conditioning	3	1	0	4	40	60	100	4
2	BTEC-401-18	Analog Circuits	3	1	0	4	40	60	100	4
3	BTEC- 302-18	Digital System Design	3	0	0	3	40	60	100	3
4	BTEC-403-18	Signals and Systems	3	1	0	4	40	60	100	4
5	HSMC122-18	Universal Human Values – 2: Understanding Harmony	3	0	0	3	40	60	100	3
6	EVS-201-18	Mandatory Course-Environmental Sciences	3	0	0	3	100	00	100	Non-credit
7	BTEI-411-18	Transducers and Signal Conditioning Laboratory	0	0	2	2	30	20	50	1
8	BTEC-411-18	Analog Circuits Laboratory	0	0	2	2	30	20	50	1
9	BTEC- 312-18	Digital System Design Laboratory	0	0	2	2	30	20	50	1
10	BMPD-341-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit
		Total	**17**	**1**	**8**	**25**	**390**	**360**	**750**	**21**

Semester V [Third year]										
Branch/Course: Electronics and Instrumentation Engineering										
Sr. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**Hrs.**	**Internal Marks**	**External Marks**	**Total**	**Credits**
1	BTEI-501-18	Biomedical Instrumentation	3	0	0	3	40	60	100	3
2	BTEC-502-18	Digital Control Systems	3	1	0	4	40	60	100	4
3	BTEC-503-18	Linear Integrated Circuits	3	0	0	3	40	60	100	3
4	BTEC-402-18	Microprocessors and Microcontrollers	3	0	0	3	40	60	100	3
5	BTEI-906X-18	Professional Elective-1	3	0	0	3	40	60	100	3
6	BTOEI-XX1-18	Open Elective-1	3	0	0	3	40	60	100	3
7	BTEC-412-18	Microprocessors and Microcontrollers Laboratory	0	0	2	2	30	20	50	1
8	BTEC-513-18	Linear Integrated Circuits Laboratory	0	0	2	2	30	20	50	1
9	BTEI-521-18	4-Week Industrial Training -I	0	0	6	6	60	40	100	3
10	BMPD-351-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit

		Total	**18**	**0**	**12**	**28**	**360**	**420**	**800**	**24**

Semester VI [Third year]										
Branch/Course: Electronics and Instrumentation Engineering										
Sr. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**Hrs**	**Internal Marks**	**External Marks**	**Total**	**Credits**
1	BTEI-601-18	Instrumentation System Design	3	1	0	4	40	60	100	4
2	BTEC-602-18	Digital Signal Processing	3	1	0	4	40	60	100	4
3	BTEI-602-18	Data Acquisition and Telemetry	3	1	0	4	40	60	100	4
4	BTEI-907X-18	Professional Elective-2	3	0	0	3	40	60	100	3
5	BTOEI-XX2-18	Open Elective-2	3	0	0	3	40	60	100	3
6	BTMC-108-18	Mandatory Course Indian Constitution	3	0	0	3	40	60	100	Non-credit
7	BTEI-611-18	Instrumentation Systems Laboratory	0	0	4	4	30	20	50	2
8	BTEI-612-18	Simulation Laboratory	0	0	4	4	30	20	50	2
9	BMPD-361-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit
		Total	**18**	**0**	**10**	**27**	**300**	**400**	**700**	**22**

Semester VII/VIII [Fourth year]										
Branch/Course: Electronics and Instrumentation Engineering										
Sr. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**Hr**	**Int Marks**	**Ext Marks**	**Total**	**Credits**
1	BTEI-907X-18	Professional Elective-3	3	0	0	3	40	60	100	3
2	BTEI-908X-18	Professional Elective-4	3	0	0	3	40	60	100	3
3	BTEI-909X-18	Professional Elective-5	3	0	0	3	40	60	100	3
4	BTOEI-YYY-18	Open Elective-3	3	0	0	3	40	60	100	3
5	BTOEI-ZZZ-18	Open Elective-4	3	0	0	3	40	60	100	3
6	BTMC-102-18	Essence of Indian Traditional Knowledge	3	0	0	3	40	60	100	Non-credit
7	BTEC-731-18	Project-II & Report	0	0	12	12	120	80	200	6
8	BTEC-12X-18	Professional Elective 3 or 4 Lab (Optional)	0	0	2	2 Satisfactory/Un-satisfactory				Non-credit
9	BMPD-371-18	Mentoring and Professional Development	0	0	2	2 Satisfactory/Un-satisfactory				Non-credit
		Total	**18**	**0**	**16**	**34**	**360**	**440**	**800**	**21**

Semester VII/VIII [Fourth year] B.Tech. Electronics and Instrumentation Engineering						
Sr. No.	**Course code**	**Course Title**	**Internal Marks**	**External Marks**	**Total**	**Credits**
1	BTEI- 801-18	Semester Software/Industrial Training & Project	300	200	500	16
		Total	**300**	**200**	**500**	**16**
Total Marks (including B.Tech. 1st Year)			**2580**	**2740**	**5500**	**166**

OR

If the students (minimum 8 students) of any Institute/College do not opt for semester training, then the students shall be required to study the following:

Semester VII/VIII [Fourth year] Branch/Course: Electronics and Instrumentation Engineering										
Sr. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Hr**	**Int Marks**	**Ext Marks**	**Total**	**Credits**
1	BTEI/C-aaaa-18	Professional Elective	3	0	0	3	40	60	100	3
2	BTEI/C-bbbb-18	Professional Elective	3	0	0	3	40	60	100	3
3	BTEI/C-cccc-18	Professional Elective	3	0	0	3	40	60	100	3
4	BTEI/C-dddd-18	Professional Elective	3	0	0	3	40	60	100	3
5	BTEI-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 course in HUSS group as given in AICTE Model Curriculum 2018.

PROFESSIONAL (PROGRAM) ELECTIVE (PE) COURSES [ELECTRONICS AND INSTRUMENTATION ENGINEERING]

The Professional Electives are categorized into five different Groups viz. Information & Communication Technology (ICT), Communication Systems, Electronic Hardware, Software Development and Signal Processing. 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 the five listed groups. It is expected of a student to complete all the six courses from the relevant group. 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. The permission for the same shall have to be obtained from the University with supporting reasons

Sr. No.	Semester	Professional Elective	Course Code	Course Title	Hrs/week	Credits
1.	V	PE-1	BTEE-403-18	Power Electronics	3L:0T:0P	3
2.	V	PE-1	BTEC-301-18	Electronic Devices	3L:0T:0P	3
3.	V	PE-1	BTEC-501-18	Analog and Digital Communication	3L:0T:0P	3
4.	V	PE-1	BTEE-602C-18	Electrical Drives	3L:0T:0P	3
5.	VI	PE-2	BTE1-906A-18	Distributive Control Systems	3L:0T:0P	3
6.	VI	PE-2	BTEI-906B-18	Optimal Control Systems	3L:0T:0P	3
7.	VI	PE-2	BTEI-906C-18	Adaptive Control Systems	3L:0T:0P	3
8.	VI	PE-2	BTEI-906D-18	Non-Linear Control Systems	3L:0T:0P	3
9.	VII	PE-3	BTEC-906E-18	Cellular and Mobile Communication	3L:0T:0P	3
10.	VII	PE-3	BTEC-603-18	Optical Fibres and Communication	3L:0T:0P	3
11.	VII	PE-3	BTCS-602-18	Computer Networks	3L:0T:0P	3
12.	VII	PE-3	BTEC-906B-18	Satellite Communication	3L:0T:0P	3
13.	VII	PE-3	BTEI-907A-18	PLC, DCS and SCADA	3L:0T:0P	3
14.	VII	PE-3	BTEI-907B-18	Mechatronics	3L:0T:0P	3
15.	VII	PE-4	BTEI-908A-18	Intelligent Robotics	3L:0T:0P	3
16.	VII	PE-4	BTEI-908B-18	Industrial Automation	3L:0T:0P	3
17.	VII	PE-4	BTEI-908C-18	Machine Vision	3L:0T:0P	3
18.	VII	PE-4	BTEI-908D-18	Embedded Systems	3L:0T:0P	3
19.	VII	PE-5	BTEI-909A-18	Neural Networks and Fuzzy systems	3L:0T:0P	3
20.	VII	PE-5	BTEC-906A-18	Wireless Sensor Networks	3L:0T:0P	3
21.	VII	PE-5	BTEI-909B-18	Smart Sensors and Networking	3L:0T:0P	3
22.	VII	PE-5	BTEI-909C-18	Sensors for Engineering Applications	3L:0T:0P	3
23.	VII	PE-5	BTEI-909D-18	Advanced Sensors	3L:0T:0P	3

LIST OF OPEN ELECTIVE (OE) COURSES OFFERED BY DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING FOR STUDENTS OF OTHER PROGRAMS

Sr. No	Course Code	Open Elective	Sem	Course Title	L	T	P	Hours/ Week	Credits
1.	BTEC-302-18	OE-1	Odd	Digital System Design	3	0	0	3	3
2.	BTEI-301-18	OE-1	Odd	Electronic Measurements and Instrumentation	3	0	0	3	3
3.	BTEC-301-18	OE-1	Odd	Electronic Devices	3	0	0	3	3
4.	BTEI-905A-18	OE-1	Odd	Power Plant Instrumentation	3	0	0	3	3
5.	BTEI-401-18	OE-2	Even	Transducers and Signal Conditioning	3	0	0	3	3
6.	BTEC-401-18	OE-2	Even	Analog Circuits	3	0	0	3	3
7.	BTEC-403-18	OE-2	Even	Signals and Systems	3	0	0	3	3
8.	BTEI-906D-18	OE-2	Even	Adaptive Control Systems	3	0	0	3	3
9.	BTEC-502-18	OE-3	Odd	Digital Control Systems	3	0	0	3	3
10.	BTEI-501-18	OE-3	Odd	Bio Medical Instrumentation	3	0	0	3	3
11.	BTEC-503-18	OE-3	Odd	Linear Integrated Circuits	3	0	0	3	3
12.	BTEI-601-18	OE-4	Odd	Instrumentation System Design	3	0	0	3	3
13.	BTEE-403-18	OE-4	Odd	Power Electronics	3	0	0	3	3
14.	BTEI-602-18	OE-4	Odd	Data Acquisition and Telemetry	3	0	0	3	3
17.	BTEI-908D-18	OE-6	Even	Embedded Systems	3	0	0	3	3
18.	BTEC-906A-18	OE-6	Even	Wireless Sensor Networks	3	0	0	3	3
19.	BTEI-906D-18	OE-7	Odd	Non-Linear Control Systems	3	0	0	3	3
20.	BTEC-906E-18	OE-7	Odd	Cellular and Mobile Communication	3	0	0	3	3
21.	BTEI-908D-18	OE-7	Odd	Evolutionary Algorithms	3	0	0	3	3

MANDATORY COURSES (Non-Credit Courses)

Sr. No.	Mandatory Course	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

IK Gujral Punjab Technical University Kapurthala

Subjects for Minor Degree in B.tech Electronics and Instrumentation Engineering (EIE)

Core Subjects:

S.No.	Subject Code	Course Title	Credits
1.	BTEC-305-18	Basic Electronics	3
2.	BTEC-306-18	Digital Electronics	3
3.	BTEI-301-18	Electronic Measurements and Instrumentation	4
4.	BTEC-401-18	Analog Circuits	4
5.	BTEI-401-18	Transducers and Signal Conditioning	3
6.	BTEC-403-18	Signals and Systems	4
7.	BTEI-501-18	Biomedical Instrumentation	3
8.	BTEC-503-18	Linear Integrated Circuits	3
9.	BTEC-504-18	Control Systems	4
10.	BTEI-602-18	Data Acquisition and Telemetry	3
11.	BTEC-602-18	Digital Signal processing	4
12.	BTEC-604-18	Microwave and Antenna Engg.	4

Elective Subjects

S.No.	Subject Code	Course Title	Credits
1.	BTEI-905A-18	Power Plant Instrumentation	3
2.	BTEI-905B-18	Nuclear Instrumentation	3
3.	BTEI-905C-18	Virtual Instrumentation	3

4.	BTEI-905D-18	Pneumatic and Hydraulic Instrumentation	3
5.	BTE1-906A-18	Distributive Control Systems	3
6.	BTEI-906B-18	Optimal Control Systems	3
7.	BTEI-906C-18	Adaptive Control Systems	3
8.	BTEI-906D-18	Non-Linear Control Systems	3
9.	BTEC-906E-18	Cellular and Mobile Communication	3
10.	BTEC-906E-18	Satellite Communication	3
11.	BTEI-907A-18	PLC, DCS and SCADA	3
12.	BTEI-907B-18	Mechatronics	3
13.	BTEI-907D-18	Industrial Automation	3
14.	BTEI-908A-18	Machine Vision	3
15.	BTEI-908D-18	Embedded Systems	3
16.	BTEC-906A-18	Wireless Sensor Networks	3
17.	BTEI-908E-18	Smart Sensors and Networking	3
18.	BTEI-908F-18	Sensors for Engineering Applications	3
19.	BTEI-908G-18	Advanced Sensors	3

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.

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

18/05/2021

B.Tech.

Electronics & Instrumentation Engineering

Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

BTEC-301-18	Credits	L	T	P	Int	Ext
Electronic Devices	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to recall concepts of semiconductor physics and understand behavior and working of semiconductor devices using mathematical models.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand physics of semiconductors and behavior of charge carriers within semiconductors
2. Understand of working of semiconductor diodes supported with mathematical explanation.
3. Understand working of BJT and MOSFET with their equivalent small signal models.
4. Understand chemical processes used fabrication of integrated circuits.

Unit 1: Semiconductor Physics

Review of quantum mechanics; electrons in periodic lattices; e-k diagrams; energy bands in intrinsic and extrinsic silicon; diffusion current; drift current; mobility and resistivity; sheet resistance; design of resistors.

Unit 2: Diodes

Generation and recombination of carriers; Poisson and continuity equation p-n junction characteristics; V-I characteristics; small signal switching models; avalanche breakdown; Zener diode; Schottky diode; light emitting diode; tunnel diode; solar cell.

Unit 3: Transistors

Bipolar junction transistor; V-I characteristics; Ebers-Moll model; MOS capacitor; C-V characteristics; MOSFET; I-V characteristics; and small signal models of MOS transistor.

Unit 4: Fabrication Processes

Oxidation; diffusion; ion-implantation; photolithography; etching; chemical vapor deposition; 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.
5. Y. Tsividis and M. Colin, *Operation and Modeling of the MOS Transistor*, Oxford University Press

BTEI-301-18	Credits	L	T	P	Int	Ext
Electronic Measurements and Instrumentation	3	3	0	0	40	60

Course Objective

It is one of the basic courses of electronic measurements which focuses on different concepts in Instrumentation Engineering used for measurement of basic parameters.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand the working of general instrument system with accuracy precision and resolution.
2. Test and troubleshoot electronic circuits using various measuring instruments
3. Understand the working and measurement of different parameters with CRO.
4. Understand the working of signal generator and frequency counter used for generating different waveforms.

Unit 1: Measurement Systems

Measurement system architecture, errors in measurements. Standards used in measurement. Accuracy, precision, resolution and noise. Classification and working of AC and DC bridges.

Unit 2: Basic Parameter Measurements

Moving coil and moving iron instruments, AC and DC voltmeter Electronic Multimeter (DVM), Watt meter, Energy Meter, Clip on meter, LCR -Q meter: Basic circuit and applications. Series and parallel connection of capacitor and inductor.

Unit 3: Oscilloscopes

Block diagram of CRO Cathode ray tube: construction, operation, screens, graticules, Vertical deflection system, Horizontal deflection system, Delay line, Measurement of frequency, time delay, phase angle and modulation index (trapezoidal method), Oscilloscope probe: structure of 1:1 and 10:1 probes, multiple trace CRO, Digital storage oscilloscope and its features.

Unit 4: Instruments for Generation and Analysis of waveforms

Audio frequency signal generators and function generators, Pulse and square wave generator, Simple frequency counter, Display counters and cascading counters. Multiplexing of display in frequency counters, Harmonic distortion analyzers, Digital IC tester.

Recommended Books

1. AK Sawhney Electrical& Electronic Measurement & Instrumentation, Dhanpat Rai Publishers
2. Cooper, WD Halfrick, AB Electronic Instruments & Measurement Techniques, PHI Learning
3. Joseph, J.Carr ,Elements of electronic Instrumentation and Measurement ,Pearson Education David,Bell Electronic Instrumentation and Measurements, P HI Learning

BTEC-303-18	Credits	L	T	P	Int	Ext
Electromagnetic Waves	4	3	1	0	40	60

Course Objective

This course deals with mathematical background required for better understanding of communication systems and signal processing.

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
5. Analyze wave propagation on parallel waveguides in modal form
6. Understand principle of radiation and radiation characteristics of an antenna

Unit 1: Transmission Lines

Equations of voltage and current on transmission line; propagation constant and characteristic impedance, and reflection coefficient and VSWR; impedance transformation on loss-less and low-loss transmission line; Power transfer on transmission line; Smith chart; admittance Smith chart; applications of transmission lines; impedance matching; use transmission line sections as circuit elements.

Unit 2: Maxwell's Equations

Basics of vectors; vector calculus; basic laws of electromagnetics; Maxwell's equations; boundary conditions at media Interface.

Unit 3: Uniform Plane Wave

Uniform plane wave; propagation of wave; wave polarization; Poincare's sphere; wave propagation in conducting medium; phase and group velocity; power flow and Poynting vector; surface current and power loss in a conductor.

Unit 4: Plane Waves at a Media Interface

Plane wave in arbitrary direction; reflection and refraction at dielectric interface; total internal reflection; wave polarization at media interface; reflection from a conducting boundary.

Unit 5: Wave propagation in parallel plane waveguide

Analysis of waveguide general approach; rectangular waveguide, modal propagation in rectangular waveguide; surface currents on the waveguide walls, field visualization, attenuation in waveguide.

Recommended Books

1. RK Shevgaonkar, *Electromagnetic Waves*, Tata McGraw Hill India
2. EC Jordan & KG Balmain, *Electromagnetic waves & Radiating Systems*, PHI
3. N Rao,*Engineering Electromagnetics*, Prentice Hall
4. DCheng, *Electromagnetics*, Prentice Hall
5. W H Hayt & J A Buck,*Engineering Electromagnetics*, McGraw Hill

BTEC-304-18	Credits	L	T	P	Int	Ext
Network Theory	4	3	1	0	40	60

Course Objective

This course is meant to create mathematical foundation which can further be extrapolated to understand and analyze the electrical networks.

Course Outcomes

At the end of this course student will be able to:

1. Analyze linear networks using network theorems.
2. Use Laplace transform to analyze transient & steady state response of linear networks.
3. Comprehend network parameters to analyze two port networks.
4. Realize one port networks using Foster's and Cauer's methods.

Unit 1: Network Theorems

Node and mesh analysis; impedance matrix approach for networks analysis; Network theorems: superposition, reciprocity, Thevenin's, Norton's, maximum power Transfer, compensation and Tallegen's theorem;Wye-Delta transformation.

Unit 2: Transient & Steady State Analysis

Laplace transforms: partial fractions, singularity functions, waveform synthesis; time domain analysis of RC, RL & RLC networks with and without initial conditions; steady state response of networks to non-sinusoidal periodic inputs; power factor; quality factor of inductor & capacitors.

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.

Unit 4: Network Synthesis

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, SP Shyammohan, *Circuits and Network*, Tata McGraw-Hill
4. A William Hayt, *Engineering Circuit Analysis*, McGraw-Hill Education

BTAM303-23	Mathematics-III (Integral Transforms, Probability & Statistics)	L-4, T-1, P-0	4 Credits

Pre-requisite: Intermediate Calculus and Basic algebra

Course Objectives: The objective of this course is to introduce integral transforms and fundamental concepts of theory of probability and statistics. The major focus of the course will be on a systematic mathematical treatment of these concepts and their applications.

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

CO1	Apply Laplace transform for solving certain differential equations arising in mathematical modeling of various real-world phenomena.
CO2	Create Fourier series expansions of periodic functions, study of their properties and applications. Also to apply Fourier transform to deal with non-periodic functions.
CO3	Apply Z-transform for solving difference equations.
CO4	Understand and deal with randomness occurring in real world phenomena.
CO5	Understand and utilize theory of probability, discrete and continuous distributions.
CO6	Apply method of least squares in fitting of curves

Detailed Content:

Unit-I

Laplace Transform

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 solve initial value problems of ordinary differential equations.

Unit II

Fourier Series and Transform

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 III

Z-Transform

Basic theory of Z transforms, Translation theorem, Scaling property of Z transforms, Initial and Final value theorems, Differentiation of Z transforms Solution of Difference equations using Z transform, Applications of Z transforms to find the sum of series.

Unit IV

Probability and Statistics

Measures of central tendency: Mean, median and mode. Definition of Probability, Discrete and continuous random variables, Probability distributions: Binomial, Poisson and Normal. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Recommended Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. R K Jain and S.R.K. 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.
6. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, 33rd Edition, 2005.

BTEC-311-18	Credits	L	T	P	Int	Ext
Electronic Devices Lab	1	0	0	2	30	20

Course Objective

This is basic course meant to give hands on experience of semiconductor devices and making them to use in circuits & projects.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Realize use of diodes in circuits with proper understanding to their working.
2. Understand characteristics & working of BJT in different configurations.
3. Understand characteristics & working of MOSFET in circuits.
4. Think and design working circuits based ondiodes, BJTs and MOSFETs.

Part-A: Experiments

1. Study of datasheets of semiconductor devices.
2. V-I characteristics of PN junction Zener diode.
3. Zener diode as voltage regulator.
4. Half-wave rectifier.
5. Full-wave center-tapped and bridge rectifier.
6. Input & output V-I characteristic curve of npn/pnp BJT in CE configuration
7. Input & output V-I characteristic curve of npn/pnp BJT in CB configuration
8. Input & output V-I characteristic curve of npn/pnp BJT in CC configuration
9. BJTs (npn & pnp) as switches to drive a relay
10. Characteristics curves of enhancement type n-channel MOSFET
11. pMOS and nMOS as switch to derive a relay

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. 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

BTEI-311-18	Credits	L	T	P	Int	Ext
Electronic Measurements & Instrumentation Lab	1	0	0	2	30	20

Course Objective

It is a laboratory course taught to give hands on experience of measurement techniques of various electronic parameters.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand the electronic measurements with various types of AC/DC bridges.
2. Understand the different parameter measurements with CRO.
3. Understand the features of Digital Storage Oscilloscope.

Part-A: Experiments

1. Familiarization with Digital Multimeter.
2. Measurement of inductance by Maxwell's bridge

3. Measurement of small resistance by Kelvin's bridge
4. Measurement of capacitance of Schering bridge
5. Measurement of frequency by Wein's bridge
6. Measurement of medium resistance by Wheat stone's bridge
7. Determination of frequency & phase angle using CRO
8. To find the Q of a coil by using LCR-Q meter
9. Demonstrate the features of digital storage oscilloscope
10. To test different ICs with IC tester.

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. Touch dimmer switch circuit
2. Precision potentiometer
3. Car battery Voltmeter
4. Function Generator circuit

HSMC 101-18/HSMC 102-18	Credits	L	T	P	Int	Ext
Foundational Course in Humanities (Development of Societies/Philosophy	3	2	1	0	40	60

The syllabus is to be finalized by the Department of Human Values and Professional Ethics.

BTEI-321-18	Credits	L	T	P	Int	Ext
4-Week Institutional Training	4	0	0	8	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 student wise of each activity conducted and the same shall be submitted to the department.

FOURTH SEMESTER

B.Tech.

Electronics & Instrumentation Engineering

Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

BTEI-401-18	Credits	L	T	P	Int	Ext
Transducers and Signal Conditioning	3	3	0	0	40	60

18/05/2021

Course Objective

This is a basic course with elementary concepts about the working of different types of transducers which are used for measurements of electrical and nonelectrical quantities in the industry.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand the selection criteria of a transducer for a particular application.
2. Understand the working and principle of operation of resistive, capacitive and inductive transducers.
3. Explain the working and fundamental concepts in principle of operation of active transducers.
4. Understand the working of Optical transducers.
5. Understand the concepts of signal conversion and signal conditioning methods.

Unit 1: Measurements and Instrumentation of a Transducer

Measurement systems, Basic electronic measuring system, Units and Standard, Transduction principles, Classification of transducers, General transducers characteristics, Criteria for transducer selection.

Unit 2: Resistive Transducers

Principles of operation, construction, theory, advantages and disadvantages, applications of Potentiometers, strain gauges, (metallic and semi-conductor type), Resistance Thermometer, Thermistors.

Unit 3: Inductive Transducers

Types of Inductive transducer, Principles of operation, construction, Advantages & disadvantages and applications. Various variable Inductive Transducers, LVDT and RVDT.

Unit 4: Capacitive Transducers

Types of capacitive transducer, Principles of operation, construction, theory, advantages and disadvantages and applications, of capacitive transducers based upon familiar equation of capacitance.

Unit 5: Active Transducers

Principle of operation, construction, theory, advantages and disadvantages and applications of following transducers: Thermocouple, Piezo-electric transducer, Magneto-strictive transducer, Hall effect transducer.

Unit 6: Other Transducers

Optical transducers: Photo-emissive, Photo-conductive and Photo-voltaic cells, Digital Transducers: Optical encoder, Shaft encoder

Unit 7: Signal Conditioning

Concept of signal conditioning, Introduction to AC/DC Bridges. Op-amp circuits used in instrumentation, Instrumentation amplifiers, analogue-digital sampling, introduction to A/D and D/A conversion, signal filtering, averaging, correlation, Interference, grounding and shielding.

Recommended Books

1. Murty DVS, Transducers & Instrumentation, Prentice Hall of India
2. Sawhney AK, Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai and Sons
3. Kalsi HS, Electronic Instrumentation, Tata McGraw Hill
4. Doebelin EO, Measurement Systems: Application and Design, Tata McGraw Hill

BTEC-401-18	Credits	L	T	P	Int	Ext
Analog Circuits	4	3	1	0	40	60

Course Objective

This course deals design & analytical concepts of various Analog circuits like BJT/FET circuits, feedback amplifiers, oscillators, power amplifiers and DAC & ADC converters.

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 the functioning of OP-AMP and design OP-AMP based circuits
5. Explain the design of ADC and DAC.

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& CHalkias, *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. AS Sedra& KC Smith, *Microelectronic Circuits*, Saunder's College Publishing

BTEC-302-18	Credits	L	T	P	Int	Ext
Digital System Design	3	3	0	0	40	60

Course Objective

This is course deals with fundamental concepts of digital electronics necessary many other courses, like embedded systems, VLSI and computer architecture, etc. to be studied in coming semesters.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Apply concepts of Boolean algebra for handling logical expressions.
2. Understand working and realization of combinational circuits.
3. Understand working flip-flops and use them in designing of sequential circuits.
4. Understand fundamental concepts of logic families and architectural of programmable devices.
5. Use HDL programming tool for simulation of combinational & sequential circuits.

Unit 1: Boolean Algebra

Logic gates; Boolean algebra; De Morgan's theorem, SOP & POS forms, canonical forms, Karnaugh maps up to 6 variables, binary codes, code Conversion.

Unit 2: Combinational Circuits

MSI devices like comparators; multiplexers; encoder; decoder; driver & multiplexed display; half and full adders; subtractors; serial and parallel adders; BCD adder; barrel shifter and ALU.

Unit 3: Sequential Circuits

Building blocks of sequential circuits like S-R, J-K,T & D flip-flops; master-slave J-K FF; edge triggered FF; ripple counters; synchronous counters; shift registers; finite state machines; design of synchronous FSM, algorithmic state machines charts; designing synchronous circuits like pulse train generator; pseudo random binary sequence generator; clock generation.

Unit 4: Logic Families& Programmable Devices

Specifications: noise margin, propagation delay, fan-in, fan-out, tristate; TTL, ECL, CMOS families and their interfacing; architectures of PLA, PAL, GAL, CPLD&FPGA.

Unit 5: VHDL Design Flow

Hardware Description Languages; VHDL constructs; Data types and objects; different modeling styles in VHDL; Dataflow, Behavioral and Structural Modeling; Synthesis and Simulation; HDL programming for basic combinational and sequential circuits.

Recommended Books

1. R.P. Jain, *Modern digital Electronics*, Tata McGraw Hill
2. Douglas Perry, *VHDL*, Tata McGraw Hill
3. W.H. Gothmann, *Digital Electronics-An introduction to theory and practice*, PHI
4. D.V. Hall, *Digital Circuits and Systems*, Tata McGraw Hill
5. Charles Roth, *Digital System Design using VHDL*, Tata McGraw Hill

BTEC-403-18	Credits	L	T	P	Int	Ext
Signals & Systems	4	3	1	0	40	60

Course Objective: The objective of this course is to enable students to apply mathematical concepts and tool in analysis of electrical signals and systems.

Course outcomes:

At the end of this course students will demonstrate the ability to:

1. Mathematically characterize different types of signals and systems.
2. Analyze the behavior of linear-shift invariant systems.
3. Apply concepts of Fourier and Laplace Transforms to analyze continuous-time signals and systems.
4. Investigate discrete-time signals and systems using Discrete-Time Fourier and Z-Transforms.

Unit 1: Introduction to Signals and Systems

Signals and systems as seen in everyday-life; 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 behavior 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 behavior.

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.

Text/Reference 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 andSons

HSMC 122-18	Credits	L	T	P	Int	Ext
Universal Human Values-2 : Understanding Harmony	3	2	1	0	40	60

The syllabus is same as given in AICTE Model Curriculum 2018 group of HUSS courses.

BTMC-XXX-18	Credits	L	T	P	Int	Ext
Mandatory Course: Environmental Sciences	Non-credit	2	0	0	60	40

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 rahabilitation 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 vi) To work in kitchen garden for mess

j) To know about the different varieties of plants

k) Shutting down the fans and ACs of the campus for an hour or so

l) Visit to a local area to document environmental assets

river/forest/grassland/hill/mountain/lake/Estuary/Wetlands

m) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural

n) Visit to a Wildlife sanctuary, National Park or Biosphere Reserve

Suggested Readings

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

2. BharuchaErach, 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

BTEI-411-18	Credits	L	T	P	Int	Ext
Transducers and Signal Conditioning Lab	1	0	0	2	30	20

Course Objective

It is a basic course taught to give hands on experience in measurement of various electrical and non-electrical quantities with the use of transducers.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Plot the input output characteristics of different transducers and explore certain static dynamic characteristics of various types of transducers.
2. Understand the use of transducers and their interfacing with associated circuitry for the measurement of different physical quantities.

Part-A: Experiments

1. To Study and plot the Characteristics of Strain gauge.
2. To Study the Characteristics of load cell.
3. To Study and plot the Characteristics of thermistor.
4. To Study the Characteristics of RTD.
5. To Study Characteristics of Thermocouple.
6. To Study the Characteristics of LDR.
7. To analyze the Loading effect of Potentiometer.
8. To measure displacement using an LVDT (linear variable differential transformer).
9. To measure the vibrations of system using a piezoelectric crystal.
10. To measure the speed using proximity type sensor.

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. Sound Level Meter
2. Water Level Sensor Circuit with Alarm
3. Dew Sensitive switch
4. Temperature Controlled LED
5. Digital temperature sensor

BTEC-411-18	Credits	L	T	P	Int	Ext
Analog Circuits Lab	1	0	0	2	30	20

Course Objective

This laboratory course deals design & analytical concepts of various analog circuits like BJT/FET circuits, feedback amplifiers, oscillators, power amplifiers and DAC & ADC converters.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. study and verify the characteristics of diodes in circuits with proper understanding to their working.
2. Understand characteristics & working of BJT in different configurations.
3. Understand characteristics & working of OP-AMPs in circuits.
4. Think and design working circuits based on diodes, BJTs and MOSFETs.

Part-A: Experiments

List of Experiments:

1.To study the Input/Output V-I characteristics of BJT in CE configuration.
2.To study Emitter follower circuit.
3. To calculate the frequency of RC phase shift oscillator.
4.To study the frequency response of Wein bridge oscillator.
5. To study the frequency response of Hartley oscillator.
6. To study the frequency response of Colpitt's oscillator.
7. To study Gain analysis of Class-A Power Amplifier
8. To study Gain analysis of Class-B Power Amplifier
9. To study Gain analysis of Class B Push-pull Power Amplifier
10. To study Gain analysis of Class-C Power Amplifier

Part-B: Lab Projects

Every individual student is required design one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1. BJT audio amplifier
2. Op-Amp based square and triangular waveform generator
3. Any project based on IoT/Arduino platform

BTEC-311-18	Credits	L	T	P	Int	Ext
Digital System Design Lab	1	0	0	2	30	20

Course Objective

This is laboratory course meant to realize basic digital circuits using physical components and EDA tools in simulation environment.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Realize combinational circuits using logic gates.
2. Realize sequential circuits using logic gates.
3. Write & simulate VHDL programs for combinational & sequential circuits.
4. Think and design working projects using digital 74XX ICs.

Part-A: Experiments

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 8x3encoder.
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-7 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

BMPD-431-18	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 & Instrumentation Engineering

Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

BTEI-501-18	Credits	L	T	P	Int	Ext
Biomedical Instrumentation	4	3	1	0	40	60

Course Objective

To give a brief introduction to human physiology and various instrumentations system for measurement and analysis of physiological parameters.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. understand basic Biomedical Instruments and their functioning
2. describe Microelectrodes, Electro conduction systems

3. explain ECG, EEG, EMG, ERG, etc.
4. understand Ventilators and other important Clinical Instruments

Unit 1: Introduction to Biomedical Instrumentation

Development of biomedical instrumentation, biometrics, man instrument system components block diagram, physiological systems of the body (brief discussion on Heart and cardio vascular system, Anatomy of nervous system, Physiology of respiratory systems) problems encountered in biomedical measurements. Sources of bioelectric potentials – resting and action potentials - propagation of action potentials – bio electric potentials example (ECG, EEG, EMG, ERG, EOG,EGG etc.)

Unit 2: Microelectrodes

Bio potential electrodes – theory – microelectrodes – skin surface electrodes – needle electrodes – biochemical transducers – transducers for biomedical applications. Electro-conduction system of the heart. Electro cardiography – electrodes and leads – Einthoven triangle, ECG read out devices, ECG machine – block diagram.

Unit 3: Biomedical Measurements

Measurement of blood pressure – direct and indirect measurement – oscillometric measurement –ultrasonic method, measurement of blood flow and cardiac output, plethysmography –photo electric and impedance plethysmographs Measurement of heart sounds –phonocardiography. Cardiac pacemakers – internal and external pacemakers, defibrillators. Electro encephalogram –neuronal communication – EEG measurement. Muscle response– Electromyogram (EMG) – Nerve Conduction velocity measurements- Electromyogram Measurements. Respiratory parameters – Spiro meter, pneumograph

Unit 4: Ventilators and Clinical Instrumentation

Ventilators, heart lung machine, hemodialysis, lithotripsy, infant incubators X-rays- principles of generation, uses of X-rays- diagnostic still picture, fluoroscopy, angiography, endoscopy, diathermy. Basic principle of computed tomography, magnetic resonance imaging system and nuclear medicine system – radiation therapy. Ultrasonic imaging system - introduction and basic principle. Instruments for clinical laboratory – test on blood cells – chemical tests - Electrical safety– physiological effects of electric current – shock hazards from electrical equipment – method of accident prevention, introduction to tele- medicine.

Recommended Books

1. J. G. Webster, Medical Instrumentation, Application and Design, John Wiley and Sons.
2. L. Cromwell, F. J. Weibell and L. A. Pfeiffer, Biomedical Instrumentation Measurements, Pearson education, Delhi, 1990.
3. R. S. Khandpur, Handbook of Biomedical Instrumentation, Tata Mc Graw Hill.
4. J. J. Carr and J. M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education.

BTEE-502-18	Credits	L	T	P	Int	Ext
Digital Control Systems	4	3	1	0	40	60

Course Objective

This is one of the fundamental courses meant to know the concepts and behaviour of Digital Control Systems.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Obtain discrete representation of LTI systems.
2. Analyse stability of open loop and closed loop discrete-time systems.
3. Design and analyse digital controllers.
4. Design state feedback and output feedback controllers.

Unit 1: Discrete Representation of Continuous Systems

Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

Unit 2: Discrete System Analysis

Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.

Unit 3: Stability of Discrete Time System

Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design. State Space Approach for discrete time systems, State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.

Unit 4: Design of Digital Control System

Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator, Discrete output feedback control, Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems.

Recommended Books

1. K. Ogata, “Digital Control Engineering”, Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.
3. G. F. Franklin, J. D. Powell and M. L. Workman, “ Digital Control of Dynamic Systems”, Addison-Wesley, 1998.
4. B.C. Kuo, “Digital Control System”, Holt, Rinehart and Winston, 1980.

Linear Integrated Circuits	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to know the concepts of Linear Integrated Circuits and their working along with their applications.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand Differential and Cascade Amplifiers
2. Know the basics, working and characteristics of Op-Amps
3. Investigate various applications of Op-amps
4. Understand some specialized Op-Amps

UNIT I: Differential and Cascade Amplifiers

Introduction: Differential Amplifier, its Circuit Configuration, Dual Input-Balanced output Differential amplifier, Dual Input Unbalanced output, Single Input Balanced & Unbalanced Output Differential Amplifier, Amplifier with their DC and AC analysis, Differential Amplifier with Swaping resistors, Constant current bias, Current Mirror, Cascaded differential amplifier stages, Level Translator, CE-CB Configuration.

UNIT II: Introduction to Operational Amplifiers

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

UNIT III: Applications of Op-Amps

DC and AC amplifiers, Peaking Amp, Summing, Scaling and Averaging Amp, Instrumentation Amplifier, Log and Antilog Amp, Integrator, Differentiator. Active filters: First order LP Butterworth filter, Second order LP Butterworth filter, First order HP Butterworth filter, Second-order HP Butterworth filter, Higher order filters, Band Pass filter, Band reject Filter, All Pass filter, Phase shift Oscillator, Wein Bridge Oscillator, Square wave Oscillator, Basic Comparator, Schmitt trigger, V to F and F to V converters, A/D and D/A converters, Sample and Hold Circuit.

UNIT IV: Specialized IC Applications

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

Recommended Books

1. Op Amps & Linear Integrated circuits by Ramakant Gayakwad.
2. Op Amps & Linear Integrated circuits by Coughlin
3.Op Amps & Linear Integrated circuits by RaviRaj Dudeja.

BTEC-402-18	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.

Program Electives

BTEE-403-18	Credits	L	T	P	Int	Ext
Power Electronics	3	3	0	0	40	60

Course Objective

This is the course meant to gain the knowledge of important concepts related to Power Electronics and the devices.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

Unit 1: Characteristics of Semiconductor Power Devices

Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based). Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Unit 2: Controlled Rectifiers

Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor. Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Unit 3: Single-phase inverters

Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.

Unit 4: Switching Power Supplies

Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Text /Reference Books

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

BTEC-301-18	Credits	L	T	P	Int	Ext
Electronic Devices	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to recall concepts of semiconductor physics and understand the behaviour and working of semiconductor devices using mathematical models.

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand physics of semiconductors and behavior of charge carriers within semiconductors
2. Understand the working of semiconductor diodes supported with mathematical explanation.
3. Understand the working of BJT and MOSFET with their equivalent small signal models.
4. Understand the chemical processes used in fabrication of integrated circuits.

Unit 1: Semiconductor Physics

Review of quantum mechanics; electrons in periodic lattices; e-k diagrams; energy bands in intrinsic and extrinsic silicon; diffusion current; drift current; mobility and resistivity; sheet resistance; design of resistors.

Unit 2: Diodes

Generation and recombination of carriers; Poisson and continuity equation p-n junction characteristics; V-I characteristics; small signal switching models; avalanche breakdown; Zener diode; Schottky diode; light emitting diode; tunnel diode; varactor diode, solar cell, Rectifier & Regulator circuits.

Unit 3: Transistors

Bipolar junction transistor; V-I characteristics; Ebers-Moll model; Transistor Configurations - CE, CB, CC; MOS capacitor; MOSFET - Construction and Working; I-V characteristics; Depletion-type and Enhancement-type MOS.

Unit 4: Fabrication Processes

Oxidation; diffusion; ion-implantation; Annealing; photolithography; etching; chemical vapour deposition (CVD); sputtering; twin-tub CMOS process.

Recommended Books

1.G. Streetman, and S. K. Banerjee, *Solid State Electronic Devices*, Pearson.
2.D. Neamen, D. Biswas, *Semiconductor Physics and Devices*, McGraw-Hill Education
3.S. M. Sze and K. N. Kwok, *Physics of Semiconductor Devices*, John Wiley & Sons
4.C. T. Sah, *Fundamentals of solid state electronics*, World Scientific Publishing Co. Inc.

BTEC-501-18	Credits	L	T	P	Int	Ext
Analog and Digital Communication	3	3	0	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, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, Demodulation, Angle Modulation, Principles of Frequency and Pulse Modulation, Representation of FM and PM signals,

Spectral characteristics of angle modulated signals. Review of white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De emphasis, Threshold effect in angle modulation.

Unit 2: Digital Communication

Pulse modulation, Sampling process, Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation and demodulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

Unit 3: Elements of Detection Theory

Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Review of probability and random process Gaussian noise characteristics, Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. Concept of Pass band.

Unit 4: Digital Modulation schemes

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.

BTEE-602C-18	Credits	L	T	P	Int	Ext
Electrical Drives	3	3	0	0	40	60

Course Objective

This is the course meant to gain the knowledge IN Digital Image and Video Processing techniques.

Course Outcomes

At the end of this course, students will demonstrate the ability to

1. Understand the characteristicsof dc motors and induction motors.
2. Understand the principles of speed-control of dc motors and induction motors.
3. Understand the power electronic converters used for dc motor and induction motor speed control.

Unit 1: DC motor characteristics

Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation.

Unit 2: Chopper fed DC drive

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.

Unit 3: Multi-quadrant DC drive

Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking.

Unit 4: Closed-loop control of DC Drive

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.

Unit 5: Induction motor characteristics

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

Unit 6: Scalar control or constant V/f control of induction motor

Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation. Control of slip ring induction motor Impact of rotor resistance of the induction motor torque-speed curve, slip power recovery.

Recommended Books

1. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.
3. G. K. Dubey, “Fundamentals of Electrical Drives”, CRC Press, 2002.
4. W. Leonhard, “Control of Electric Drives”, Springer Science & Business Media, 2001.

Open Elective

BTOE-303-18	Credits	L	T	P	Int	Ext
Digital Systems Design	3	3	0	0	40	60

Course Objective

This is course deals with fundamental concepts of digital electronics necessary many other courses, like embedded systems, VLSI and computer architecture, etc. to be studied in coming semesters.

Course Outcomes

At the end of this course student will demonstrate the ability to:

6. Apply concepts of Boolean algebra for handling logical expressions.
7. Understand working and realization of combinational circuits.
8. Understand working flip-flops and use them in designing of sequential circuits.
9. Understand fundamental concepts of logic families and architectural of programmable devices.
10. Use HDL programming tool for simulation of combinational & sequential circuits.

Unit 1: Boolean Algebra & Combinational Circuits

Logic gates; Boolean algebra; De Morgan's theorem, SOP & POS forms, canonical forms, Karnaugh maps up to 6 variables, binary codes, code Conversion, MSI devices like comparators; multiplexers; encoder; decoder; driver & multiplexed display; half and full adders; subtractors; serial and parallel adders; BCD adder; barrel shifter and ALU.

Unit 2: Sequential Circuits

Building blocks of sequential circuits like S-R, J-K,T & D flip-flops; master-slave J-K FF; edge triggered FF; ripple counters; synchronous counters; shift registers; finite state machines; design of synchronous FSM, algorithmic state machines charts; designing synchronous circuits like pulse train generator; pseudo random binary sequence generator; clock generation.

Unit 3: Programmable Devices & ADC and DAC

Specifications: noise margin, propagation delay, fan-in, fan-out, Tristate; TTL, ECL, CMOS families and their interfacing; architectures of PLA, PAL, GAL, CPLD&FPGA. DAC: weighted resistor, R-2R ladder, resistor string; ADC: single slope, dual slope, successive approximation, flash.

Unit 4: Introduction to VHDL

VHDL constructs; Data types and objects; different modelling styles in VHDL; Dataflow, Behavioural and Structural Modelling; Synthesis and Simulation; HDL programming for basic combinational and sequential circuits.

Recommended Books

1. R.P. Jain, *Modern digital Electronics*, Tata McGraw Hill
2. Douglas Perry, *VHDL*, Tata McGraw Hill
3. W.H. Gothmann, *Digital Electronics-An introduction to theory and practice*, PHI
4. D.V. Hall, *Digital Circuits and Systems*, Tata McGraw Hill
5.Charles Roth, *Digital System Design using VHDL*, Tata McGraw Hill

BTEC-412-18	**Credits**	**L**	**T**	**P**	**Int**	**Ext**

Microprocessor and Microcontrollers 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. Write a program in MATLAB to verify linear convolution.
6. Write a program in MATLAB to verify the circular convolution.
7. To develop program for finding magnitude and phase response of LTI system Described by system function H(z).
8. To develop program for finding response of the LTI system described by the difference equation.
9. To develop program for computing inverse Z-transform.
10. To develop program for computing DFT and IDFT.
11. To develop program for conversion of direct form realization to cascade form realization.
12. To develop program for cascade realization of IIR and FIR filters.
13. To develop program for designing FIR filter.
14. To develop program for designing IIR filter.
15. To write a MATLAB program for noise reduction using correlation and autocorrelation methods.
16. To write a MATLAB programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.
17. Write a program in MATLAB to find frequency response of different types of analog filters.
18. Write a program in MATLAB to design FIR filter (LP/HP) through Window technique: Using rectangular window and triangular window.

BTEC-513-18	Credits	L	T	P	Int	Ext
Linear Integrated Circuits Laboratory	1	0	0	2	30	20

Course Objective

This laboratory course deals with the Hands-on experiments related to the study of the concepts of Linear Integrated Circuits.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. study and investigate the configurations of Differential amplifiers.
2. measure the performance parameters of am OP-Amp.
3. use Op-Amps for various applications.

List of Experiments:

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

BTEI-521-18	Credits	L	T	P	Int	Ext
4-Week Industrial Training I	3	0	0	6	60	40

Minimum of four weeks in an Industry in the area of Electrical Engineering. 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 him/her. The outcome of the internship should be presented in the form of a report.

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 incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

SIXTH SEMESTER

B.Tech.

Electronics & Instrumentation Engineering (EIE)

Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

BTEI-601-18	Credits	L	T	P	Int	Ext
Instrumentation System Design	4	3	1	0	40	60

18/05/2021

Course Objective: This course deals with theoretical background required for basic understanding in designing the Instrumentation Systems.

Course Outcome:
After completion of this course, the students would be able to:
1. Understand the design concepts of Instrumentation system
2. Demonstrate the designing fundamentals required for Industry oriented variables
3. Express the working of signal conditioning equipment.
4. Understand the design requirements for display systems

Unit 1: Instrumentation System Design
Introduction, transducer terminology, general transducer characteristics, design characteristics, performance characteristics, reliability characteristics, criterion for transducer selections.

Unit 2: Basic principles of designing transducers
Resistive, inductive, capacitive, bimetallic strips, RTD, LVDT, thermocouples, diaphragm, bellow, capsule, Rotameter, bourdon tube etc.

Unit 3: Signal Conditioning
Bridges, instrumentation amplifier, modulators & demodulators, S/H circuit, active and passive filters, and various types of ADC and DAC circuits.

Unit 4: Display system design
7 segment LED display, LED Matrix, Bar Graph LED display, 7 segment LCDs, CRT Displays
Some case studies in instrumentation

Recommended Books:
1. Norton HN, *Handbook of Transducers*, Prentice Hall 2010.
2. Neubert HKP, *Instrument Transducers* Oxford University Press 1963.
3. Pallas-Areny R and Webster JG, *Sensors and Signal Conditioning*,Wiley India Pvt Ltd. 2015.
4. Northrop RB, *Introduction to Instrumentation and Measurements*,CRC Press 2005.
5. Dally JW, Riley WF and McConnell KG, *Instrumentation for Engineering Measurements*,Wiley India 2010.
6. Rangan CS, Sharma GR and Mani VSV, *Instrumentation Devices & Systems*, Tata McGraw-Hill 1992.

BTEC-502-18	**Credits**	**L**	**T**	**P**	**Int**	**Ext**
Digital Signal Processing	4	3	1	0	40	60

Course Objective

This is one of the fundamental courses meant to know the concepts of Digital Signal Processing and understand the commonly used digital filters and systems.

Course Outcomes

At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals

3. Design of different types of digital filters for various applications

Unit 1: Discrete Time Signals

Elementary 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: LSI Systems

Analysis of LSI 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. Parametric and non-parametric spectral estimation. Matched Z-Transformation, Analog and Digital Transformation in the Frequency Domain. Finite Precision Effects**:** Fixed point and Floating point representations, Effect of round off noise in digital filters, Limit cycles.

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, Architectures of ADSP and TMS (C6XXX) series of processor.

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 andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

BTEI-602-18	Credits	L	T	P	Int	Ext

Data Acquisition and Telemetry	4	3	1	0	40	60

Course Objective: This course is offered to the strengthen the concepts related to different data acquisition systems

Course Outcome:

On successful completion of this course the student will be able to:

1. Understand the functionality of different components and configuration of data acquisition system
2. Understand the working and functionality of Analog communication techniques
3. Gain knowledge on different modulation techniques.
4. Express different telemetry systems

Unit 1: Data Acquisition System

Definition and generalized block diagram of data acquisition system (DAQ), Classification of DAQ, working principle block diagram, construction and salient features of the following data acquisition systems: Analog data acquisition system using time division multiplexing, Analog data acquisition system using frequency division multiplexing, Digital data acquisition system,Data logger.

Unit 2: Analog Communication Techniques

Analog communication techniques: analog modulation of AC carrier; amplitude modulation of AM wave and frequency spectrum, frequency modulation and frequency spectrum of FM wave, Phase modulation and frequency spectrum of PM wave. Analog modulation of pulse carrier; basis of PAM, PFM.

Unit 3:Digital Communication Techniques

Digital modulation of pulse carrier, basis of PCM, DCPM; Digital modulation of AC carrier, ASK, FSK, PSK, error detection and correction methods, error control techniques.

Unit 4:Telemetryand Telemetry Systems

Introduction, signal formation, conversion and transmission, general block diagram of telemetry system,classification of telemetry system, transmission media:wired and wireless,Direct voltage and current telemetry system, AM and FM telemetry system, Multi-channel PAM and PWM telemetry system, single and multi-channel digital telemetry system, modem based telemetry system, short range radio telemetry and satellite telemetry system, fibre optics telemetry system.

Recommended Books

1. Karp HR (Ed.),*Basics of Data Communication*,McGraw-Hill 1976.
2. Tomasi W, *Fundamentals of Electronic Communication Systems*, PHI 2008.
3. Gruenberg EL, *Handbook of Telemetry and Remote Control*,McGraw-Hill 1967.
4. Ginzberg, Lekhtman and Malov, *Fundamentals of Automation and Remote Control*,Mir Publishers 1988.
5. Rangan CS, Sharma GR and Mani VSV "*Instrumentation Devices and Systems*,Tata McGraw-Hill 2011.

Professional Elective – 2

BTEI-611-18	Credits	L	T	P	Int	Ext
Distributive Control Systems	3	0	0	0	40	60

Course Objective: This course is designed to offer in depth knowledge for understanding of distributed control in the instrumentation industry.

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

1. Discuss the general PLC programming procedures
2. Express the fundamentals related to programming and application development using SCADA system
3. Design the security approaches, engineering and operator interface issues for designing distributed control system.

Unit:1 Programmable Logic Controller (PLC) Basics
Definition, overview of PLC systems, Block diagram of PLC. General PLC programming procedures: ON/OFF instruction, Timer instruction sets, Counter Instruction sets -Design, development and simulation of PLC programme using above instruction sets for simple applications.

Unit :2-SCADA System
Concept of SCADA systems, Programming techniques for : Creation of pages, Sequencing of pages, Creating graphics & animation, Dynamos programming with variables, Trending, Historical data storage & Reporting, Alarm management, reporting of events and parameters. Comparison of different SCADApackages. Application Development using SCADA system.

Unit :3 IV-Distributed Control System
DCS Introduction, Location of DCS in Plant, functions, advantages and limitations,Comparison of DCS with PLC,DCS components/ block diagram, Architecture,Functional requirements at each level, Database management. Latest trends and developments of DCS, DCS Specification. Layout of DCS, Controller Details,
Redundancy, I/O Card Details, Junction Box and Marshalling Cabinets, Operator Interface, Workstation Layout, different types of control panels, types of Operating Station, various display configurations.

Recommended Books:

1. John W. Webb and Ronald A Reis, *Programmable Logic Controllers - Principles and Applications*, 4th Edition, Prentice Hall Inc., New Jersey 1998.
2. Lukcas M.P *Distributed Control Systems*, Van Nostrand Reinhold Co., New York 1986.
3. Frank D. Petruzella, *Programmable Logic Controllers*, 5th Edition, McGraw Hill, New York 2017.
4. Deshpande P.B and Ash R.H, *Elements of Process Control Applications*, ISA Press, New York 1995.
5 Curtis D. Johnson, *Process Control Instrumentation Technology*, 8th Edition, Prentice Hall, New Delhi 2006.

BTEI-906A-18	Credits	L	T	P	Int	Ext

Optimal Control Systems	3	3	0	0	40	60

Course Objective: This course offers the theoretical background required for getting the optimum output from the control systems

Course Outcomes: At the end of this course, students will be able to
1.Understand the basic mathematical concepts required for optimality in control systems
2 Express the principle of optimality
3 Explain different necessary conditions and assumptions for the formulation of optimal control problem
4 Explain the Pontryagin's minimum principle for basic fixed end and variable end point control problems

Unit 1: Basic mathematical concepts:
Finite dimensional optimization, Infinite dimensional optimization, Conditions for optimality, Performance measures for optimal control problems.

Unit:2 Dynamic programming
The optimal control law, The principle of optimality, Dynamic programming concept, Recurrence relation, computational procedure, The Hamilton-Jacobi-Bellman equations.

Unit :3 Calculus of variations: Examples of variational problems, Basic calculus of variations problem,Weak and strong extrema, Variable end point problems, Hamiltonian formalism and mechanics:Hamilton's canonical equations.

Unit: 4 From Calculus of variations to Optimal control: Necessary conditions for strong extrema,
Calculus of variations versus optimal control, optimal control problem formulation and assumptions, Variational approach to the fixed time, free end point problem.

Unit:5 The Pontryagin's Minimum principle: Statement of Minimum principle for basic fixed end pointand variable end point control problems, Proof of the minimum principle, Properties of theHamiltonian, Time optimal control problems

Recommended Books
1. D.E.Kirk, *Optimal Control Theory- An Introduction*, Dover Publications, New York 2004.
2. Alok Sinha, *Linear Systems- Optimal and Robust Controls*, CRC Press 2007.
3. Daniel Liberzone, *Calculus of variations and Optimal control theory*, Princiton University Press 2017.
4. Frank L. Lewis, *Applied optimal control & Estimation- Digital design and implementation*,Prentice Hall and Digital Signal Processing Series, Texas Instruments 1992.
5. Jason L. Speyer, David H. Jacobson, *Primer on Optimal Control Theory*,SIAM 2010.
6. Ben-Asher, Joseph Z, *Optimal Control Theory with Aerospace Applications*, American Institute of Aeronautics and Astronautics 2010.

Adaptive Control Systems	3	3	0	0	40	60

Course Objective: This course offers mathematical foundations required for building adaptive control systems

Course Outcomes: At the end of this course,students will be able to
1.Explain the estimation regarding real time parameters.
2 Self tuning in the regulators with disturbances.
3 Application of Kalman filtering for different control problems

Unit 1:Introduction
Parametric models of dynamical systems, Adaptive control problem, Least squares and regression models, Estimating parametersin Dynamical Systems, Experimental conditions, Prior information, MLE, RLS,Instrument variablemethod.

Unit :2 Deterministic Self tuning regulators (STR)
Pole placement design, Indirect self tuningregulators, Continuous time self tuners, Direct self tuning regulators, disturbances with knowncharacteristics.

Unit :3 Stochastic and Predictive Self tuning regulators
Design of Minimum variance and Movingaverage controllers, Stochastic self tuning regulators, Unification of direct self tuning regulators.Linear quadratic STR, adaptive predictive control.

Unit 4:Kalman Filtering and Advanced filtering
Introduction to smoothing, filtering and prediction, Kalman Filter, Application of Kalman filtering algorithm to identification and adaptive controls. Adaptive control using model reference techniques, self tunning control and self tracking control

Recommeneded Books
1. K.J. Astrom and B. Wittenmark, *Adaptive Control*, 2nd ed., Pearson Education 1994.
2. P. Ioannou and B. Fidan, *Adaptive Control Tutorial*, SIAM 2006.
3. P.A. Ioannou and J. Sun, *Robust Adaptive Control*, Prentice Hall 1996.
4. Sankar Sastry and Marc Bodson, *Adaptive Control- Stability, Convergence and Robustness*,Springer 2009.
5. M. Krstic, I. Kanellakopoulos and P. Kokotovic, *Nonlinear and Adaptive Control Design*, Wiley-Interscience 1995.
6.H. W. Sorenson, M Dekker, *Parameter estimation: principles and problems*, 1998.

BTEI-906C-18	Credits	L	T	P	Int	Ext

Non -Linear Control Systems	3	3	0	0	40	60

Course Objective: To offer various control system design techniques particularly applicable to nonlinear systems.

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

1. Investigate how nonlinear systems can be analysed as well as controlled.
2. Discuss new control methods applicable to a number of example domains, including robotics.
3.Express their ideas on general stability theory of using Lyapunov

Unit 1: Non-linear System Analysis

Concepts of phase plane analysis: phase portraits, construction of phase portrait, singular points, phase plane analysis of linear system and nonlinear system- existence of limit cycles.

Unit:2 Describing Function Analysis

describing function fundamentals-computing describing functions, common nonlinearities in control systems, describing functions of common nonlinearities, and describing functions analysis of nonlinear systems-stability analysis.

Unit:3 Lyapunov Theory

Lyapunov‟s Direct method, stability analysis based on Lyapunov's direct method, Krasovskii's method, variable gradient method.

Unit:4 Lyapunov Analysis of Non-Autonomous System.

Nonlinear control system design, feedback linearization. Passivity, Nonlinear Control, and Geometric Methods.

Recommended Books:

1. Jean-Jacques E. Slotine,*Applied Nonlinear Control*, Prentice Hall Englewood Cliffs, New Jersey 1991.
2. Khalil, H.K., "*Nonlinear Systems*," 3/e, Prentice Hall Englewood Cliffs, New Jersey 2002.
3.Vidyasagar.M, "*Nonlinear System Analysis*", Prentice Hall Englewood Cliffs, New Jersey 1998.

Open Elective - 1

(The List of Open Electives (OE) courses offered is provided in the Course Scheme above)

BTEC-611-18	**Credits**	**L**	**T**	**P**	**Int**	**Ext**
Instrumentation Systems Laboratory	1	0	0	2	30	20

Course Objective: To provide knowledge of uncertainties involved in any measurement and to train the students in the calibration and use of different measuring instruments.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. study and investigate various types of Instruments.
2. measure the performance parameters using these Instruments.
3. learn about Modulator/demodulator and CRTs..

List of Experiments:

1. To Study & Calibrate the Pressure gauge.
2. To calibrate the transducer for temperature measurements.
3. Study and Calibration of LVDT Transducer for displacement measurements.
4. To calibrate Strain gauge for temperature measurement.
5. To calibrate thermocouple for temperature measurement.
6. To Study and Observe Capacitive transducer for Angular displacement.
7. To calibrate Resistance Temperature Detector for Temperature measurement.
8. To study and Calibrate Rotameter for flow measurement.
9. To design and observe the output of an Instrumentation amplifier using Transistors.
10. To Observe the Output waveform of a Modulator/Demodulator.
11. To measure the output of an Analog to Digital Convertor/ Digital to Analog Convertor.
12. To Study and observe the output of a CRT for various measurements.

BTEC-512-18	Credits	L	T	P	Int	Ext
Digital Signal Processing Laboratory	1	0	0	2	30	20

Course Objective

This laboratory course deals with the Hands-on experiments related to the study of Digital Signal Processing and its applications.

Course Outcomes

At the end of this course student will demonstrate the ability to:
1. Write programs to develop various signals.
2. Write programs to generate standard sequences.
3. Develop programs to verify convolution
4. Develop programs to design various filters.

List of Experiments:
Perform the following exercises using MATLAB

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
2. Write a program in MATLAB to generate standard sequences.
3. Write a program in MATLAB to compute power density spectrum of a sequence.

4. To develop program modules based on operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.
5. To develop program for finding magnitude and phase response of LTI system described by system function H(z).
6. To write a MATLAB programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.

List of Lab Experiments on hardware:(using C6xxx board ,Code composer studio and Acarya app)

7. Implementation Linear and Circular Convolution
8. To Find DFT and IDFT of given time DT Signal
9. N point FFT Algorithm implementation
10. Digital Filter Design - FIR Filter Implementation
11. Digital Filter Design - IIR Filter Implementation
12. Configuring Audio Codec of C6xxx Boards
13. Configuration of Audio Input and Output Channels (Loopback/Talkback using Acarya Application)
14. Implementation of Audio Delay Line, Echo and Audio Reverberation
15. Applications - Digital Signal Generations

16. Moving Average filter Design (Noise Cancellation using Acarya Application Reference)

BTEI-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 6^{th} Semester and 7^{th} 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 SEMESTER

B.Tech.

Electronics & Instrumentation Engineering (EIE)

Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

18/05/2021

Professional Electives - 3

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.Expalin the Light wave Architecture and systems

4.Ability to explain the manufacturing, modulation and wave mixing in Optical Communication

Unit 1: Introduction

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

Unit 2: Optical Fibers

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

Unit 3: Optical Transmitters

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

Unit 4: Optical Receivers

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

Unit 5: Light Wave Systems
System Architecture, Loss limited Light wave systems, Dispersion limited Light wave systems, Power Budget, Long Haul systems, Sources of Power Penalty; Model Noise, Dispersive Pulse Broadening, Mode Partition Noise, Frequency Chirping, Reflection Feedback Noise, WDM Light wave systems, Optical TDM Systems, Subscriber Multiplexing, Code Division Multiplexing.

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. Agarwal, Fiber Optics Communication Systems John Wiley & Sons (Asia) Pvt. Ltd 1998.
4. Djafar K. Mynbeav, ―Fiber-Optics Communications Technology‖ Pearson 2001.

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 Layer Process to Process Communication - User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit 5: Application Layer - Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), World wide web (WWW), HTTP, SNMP, Bluetooth, Firewalls.

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.

BTEC-907A-18	Credits	L	T	P	Int	Ext
Mobile Communication and Networks	3	3	0	0	40	60

Course Outcomes

At the end of this course students will demonstrate the ability to:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance

Unit 1: Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Unit 2: Signal propagation- Propagation mechanism- Reflection, Refraction, Diffraction and Scattering, Large scale signal propagation, Fading channels-Multipath and small scale fading-Doppler shift, Statistical multipath channel models, Narrowband and Wideband fading models, Delay spread, Coherence bandwidth and Coherence time, Flat and frequency selective fading, Slow and Fast fading, Average fade duration and level crossing rate.

Unit 3: Othrogonal Frequency Division Multiplexing (OFDM) – OFDM Receiver & Transmitter structures- Diversity receivers- selection and MRC receivers, RAKE receiver, Equalization, Transmit diversity-Altamonte scheme.

Unit 4: MIMO and Space time signal processing - Spatial multiplexing, diversity/multiplexing tradeoff, Performance measures- Outage, SNR, symbol/bit error rate, examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

BTEI-907A-18	Credits	L	T	P	Int	Ext
PLC, DCS & SCADA	3	3	0	0	40	60

Course Objective: The main objective of this subject is to make the students understand the fundamentals of automation and various automation systems used in industry such as PLC, DCS, and SCADA.

Course Outcomes:

After completion of the course, the students would able to:

1. Define automation along with its importance and applications in the industries.
2. Understand working of PLC, I/O modules of PLC, Programming languages and instructions of PLC, design
3. Understand evolution and architecture of DCS, hierarchical control in DCS, programming DCS through function Block Diagram (FBD) method.
4. Get familiar with SCADA architecture, communication in SCADA, develop any application based on SCADA along with GUI using SCADA software.
5. Evaluate computer based automation system used in industries ranging from discrete, continuous process to hybrid processes.
6. Select hardware and software for modern automation system required for industrial application.
7. Demonstrate interfacing of hardware and software of computer based automation system.
8. Understand the need of Safety Instrumentation System

Unit 1: Processing Automation Fundamentals - Automation and its importance, automation applications, expectations of automation. Process and factory automation. Types of plant and control – categories in industry, open loop and close loopcontrol functions, continuous processes, discrete processes, and mixed processes. Automation hierarchy – large control system hierarchy, data quantity & quality and hierarchical control. Control system architecture – evolution and current trends, comparison of different architectures.

Unit 2: Programmable Logic Controller Hardware - Evolution of PLC, Definition, functions of PLC, Advantages, Architecture, working of PLC, Scan time, Types & Specifications. I/O modules, local and remote I/O expansion, special purpose modules, wiring diagrams of different I/O modules, Memory & addressing- memory organization, I/O addressing, hardware to software interface. **Software:** Development of Relay Logic Ladder Diagram, introduction to PLC Programming, programming devices, LD programming- basic LD instructions, PLC Timers and Counters, data transfer & program control instructions, advanced PLC instructions, PID Control using PLC. Case study: PLC selection and configuration for any one process applications.

Unit 3: Distributed Control System (DCS) and System Configuration - DCS: Introduction. Evolution, configurations, flow sheet symbols, architecture. Controller, Input and output modules, data highway, local I/O bus, Workstations. Introduction of Hierarchical control of memory: Higher and Lower computer level task. Supervisory computer tasks DCS configuration. Supervisory computer functions, Supervisory Control Algorithm. advanced control Strategies, computer interface with DCS. **System integration with PLCs computer:** Supervisory computer functions: Supervisory control and optimization, production monitoring and control, on-line information system DCS and supervisory computer displays- Display access method, alarm access architecture, voice input machine interface Man Machine Interface – Sequencing, Supervisory control Computer interface with DCS- Hardware: Gateway, Interface with PLC, Interface with Direct I/O, Network linkages

Software configuration: Operating system configuration, Controller function configuration, - Algorithm libraries, Process control programming: Types of program, Features of process control programs, The executive program, Programming language for process control Algorithms- The position algorithm, Velocity algorithm, cascade and ratio control, Feed-forward.

Unit 4: Supervisory Control and Data Acquisition (SCADA) - SCADA introduction, brief history of SCADA, elements of SCADA. Features of SCADA, MTU functions, RTU Functions, Protocol Detail SCADA as a real time system Communications in SCADA- types &methods used, components, Protocol structure and Mediums used for communications SCADA Development for any one typical application Programming for GUI development using SCADA software.

Unit 5: Typical DCS & SCADA systems and Safety Instrumented System- Typical DCS & SCADA systems: Honeywell PlantScape system, Foxboro I/A series DCS, Delta system, Citect, Wonderware, Safety Instrumented System (SIS):Need for safety instrumentation- risk and risk reduction methods, Hazards analysis. Process control systems and SIS.

Recommended Books:

1. Samuel M. Herb, “Understanding Distributed Processor Systems for Control”, ISA Publication
2. Overview of Industrial Process Automation by KLS Sharma, Elsevier publication
3. Process Control- Instrument Engineers Handbook by Bela G. Liptak, Chilton book co.
1. Practical Distributed Control Systems (DCS) for engineers and technicians by IDC Technologies
2. Distributed Computer Control Systems in Industrial Autoation by D. Popovic and V. Bhatkar, Marcel Dekker
3. Thomas Hughes, “Programmable Logic Controller”, ISA Publication.
4. Stuart A. Boyer, “SCADA supervisory control and data acquisition”, ISA Publication.
5. S.K.Singh, “Computer Aided Process Control”, Prentice Hall of India.
6. John. W.Webb, Ronald A Reis, “Programmable Logic Controllers – Principles and Applications”,3rd edition, Prentice Hall Inc., New Jersey, 1995.

BTEI-907B-18	Credits	L	T	P	Int	Ext
Mechatronics	3	3	0	0	40	60

Course Objective: The main objective of this course is to enlighten the students with the basic fundamentals of Mechatronics which includes Sensors and Signal processing, Mechatronic Systems along with methods to embed the microprocessor into mechatronics systems.

Course Outcomes:

After completion of the course, the students would able to:

1. Use the Sensors, various electrical and mechanical instruments in industries.
2. Justify the need for the signal conditioning circuits in the given mechatronics systems
3. Develop simple CNC program for given problem
4. Identify the use of given pneumatic components and also learn the procedure to maintain them
5. Identify the use of given hydraulic components and also learn the procedure to maintain them
6. Describe the procedure to maintain the given robotic system for specified application

Unit I: Introduction - Definition and approach of Mechatronics, Measurement and Control Systems, Mechatronics System Architecture, Introduction to real time Mechatronics systems: Block diagram and functions -Flexible Manufacturing System (FMS) and Computer integrated Machines (CIM).

Unit II: Measurements, Sensors and Signal Processing - Mechanical Measurements: Temperature, Vacuum: McLeod gauge, thermal conductivity gauge, flow measurement: orifice, venture, nozzle**.** Electrical Measurements: Resistive transducers, Inductive transducer, Capacitive transducer – Piezo electric transducer, Digital displacement transducers. Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, Proximity and Position Sensors, Velocity Sensors, Motion Sensors, Acceleration Sensors, Pressure Sensors, Torque Sensors – applications. Signal Processing: Need of isolators, filters, amplifiers, Amplification – Filtering – Sample and Hold circuits, Single channel and Multi channel data acquisition – Data logging,

Unit III: Basic Mechatronics Systems - Electrical Systems: Mathematical modeling of Electro Mechanical Systems, RLC Circuits, active and passive electrical circuits, PMDC Motor, Stepper motor, three phase squirrel cage induction motor**.** Mechanical Systems: Introduction to various systems of units, mathematical modeling of mechanical systems, Newton's laws and moment of inertia, rotational systems, spring mass system, free vibration, spring mass damper system, mechanical systems with dry friction**.** Fluid and Thermal systems: Mathematical modeling of pneumatic systems: Resistance and capacitance of pneumatic systems, Mathematical modeling of hydraulic systems: Hydraulic circuits, hydraulic servo-meter CNC Machines: General Configuration and its advantages, Part Programming of CNC Machines

Unit IV: Microprocessor and Robotics with Mechatronics Applications - Microprocessor: Architecture of Microprocssor 8085, Instruction set, Embedding a microprocessor into a Mechatronics system. Robotics:Definition, Block diagram with functions of each components, law of robotics, Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems- Pneumatic and Electric system.

Recommended Books:

1.W. Bolton, Mechatronics – Electronics Control Systems in Mechanical and Electrical Engineering, Pearson Education.
2.K.P. Ramachandran and G.K. Vijayaraghavan, Mechtronics- Integrated Mechanical Electronic Systems, Wiley
3.M. D. Singh, J. G. Joshi, Mechatronics, PHI
4.Doebelin. E. O., "Measurement Systems – Applications and Design", Tata McGraw Hill, 1992
5.Patranabis. D, "Sensors and Transducers", 2nd Edition PHI, New Delhi, 2003.
6.Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.

Professional Electives – 4

BTEI-908A-18	Credits	L	T	P	Int	Ext
Intelligent Robotics	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 so that they will be able to design the robots 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. Understand the basics of robotics
2. Know the robot transformation and sensors
3. Understand the simulation techniques essential for the robots designing
4. Get familiar with the programming concepts which are used in designing of the robots.
5. Design the desired robotic systems

Unit 1: Introduction and Robotics Principles - Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems- Pneumatic and Electric system. Work Volume, Drive systems, Control System & Dynamics, Principles: Straight lines, Angles and optimal moves circular interpolation, Robotic functions Geometrical, commands, Edit commands. Selecting robot views.

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Unit 2: End effectors and Control System - Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design, Control System Analysis, Activation & Feedback Components, Position Sensor, Velocity Sensors. Manipulator, Kinematics, Transformations, Robot Arm, Kinematics & Dynamics.

Unit 3: ROBOT TRANSFORMATIONS AND SENSORS - Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors, Range Sensors, Light Sensors, Pressure Sensors, Sensor Based Systems, Uses of Sensors in Robotics.

Unit 4: Machine Vision and Robotic Simulation - Machine vision: Introduction, Sensing & Digitizing Functions, Image Processing & Analysis
Robotic Simulation: Simulation packages, Loading the simulation, Simulation editors, delay, Resume commands. Slide commands, program flow control. Robot motion control, Analysis of robot elements, Robotic linkages. Robot Design - Linkages, Types, Transmission elements Flexible connectors, pulley-and- Belt drives, variable speed transmission. Design of Robot for particular applications – A case study.

Unit 5: Robot Programming - Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation Interlock commands- Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands. Languages: Classifications, Structures- VAL- language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, RAPID- language basic commands- Motion InstructionsPick and place operation using Industrial robot- manual mode and automatic mode, AML Language-General description, elements and functions, Statements, constants and variables-Program control statements

Recommended Books:

1. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
2. Robert J. Schilling, Fundamentals of Robotics Analysis and Control, PHI Learning, 2009.
3. Craig. J. J. "Introduction to Robotics mechanics and control", Addison- Wesley,1999.
4. Daniel L. Ryan, Robotics Simulation, CRC Press Inc., 1994.
5. Industrial Robotics by MP Groover, M Weiss (McGraw Hill Int'l)
6. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
7.

BTEI-908B-18	Credits	L	T	P	Int	Ext
Industrial Automation	3	3	0	0	40	60

Course Objective:

The main objective of this course is to enlighten the students with the basic fundamentals of Automation in Robotics, Industries Manufacturing Industries and Processing Industries, so that they will be able to understand the automation concepts in these industries.

Course Outcomes:

After completion of the course, the students would able to:

1. Get acquainted with various automation technologies in manufacturing and process industries.
2. Select suitable major control components required to automate a process.
3. Implement various control and automation method in process industries.
4. Understand various communication technologies in manufacturing and process industries.
5. Know the basics of robotics
6. Identify potential areas for automation and justify need for automation.
7. Identify suitable automation hardware for the given application.

Unit I: Introduction - Concept and scope of automation: Socio economic impacts of automation, Types of Automation, Low Cost Automation, Introduction- Automation in production system, Principles and strategies of automation, Basic elements of an automated system.

Unit II: Automation in Manufacturing Industries - Advanced automation functions, Levels of automations, Automated flow lines and transfer mechanisms, Analysis of transfer lines without storage, Automated flow lines with storage buffers. Material handling and identification technologies -Overview of material handling systems, Types of material handling equipment,

Design of the system, Conveyor system, Automated guided vehicle system, Automated storage systems, Interfacing handling and storage with manufacturing, Overview of Automatic Identification Methods. Automated Manufacturing Systems-Components, Classification and overview of manufacturing systems, Cellular manufacturing, Flexible manufacturing system (FMS) and its planning and implementation.

Unit III: Automation in Process Industries - Introduction to computer based industrial automation- Direct Digital Control (DDC), Distributed Control System (DCS) and supervisory control and data acquisition (SCADA) based architectures. SCADA for process industries includes understanding of RTUs, Pumping stations, Evacuation processes, Mass Flow Meters and other flow meters, Leak-flow studies of pipelines, Transport Automation. Programmable Logic Controller (PLC)- Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs, Integrating Process safety PLC and DCS, Application of international standards in process safety control.

Unit IV: Automation in Robotics - Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems- Pneumatic and Electric system. Work Volume, Drive systems, Control System & Dynamic**,** Principles: Straight lines, Angles and optimal moves circular interpolation, Robotic functions Geometrical , commands, Edit commands. Selecting robot views, standard Robot part

Unit V: Modelling and Simulation for Plant Automation - Introduction and process. Need for system modeling. Building model of a plant: Cement, thermal, water treatment and steel plants. Modern tools and future perspective. Industrial control applications: Cement, thermal plants. Industrial control applications: Water treatment and steel plants.

Recommended Books:

1. M.P.Groover,"Automation, Production Systems and Computer Integrated Manufacturing", 5th Edition, Pearson Education, 2009.
2. John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", 5th Edition, Prentice Hall Inc., New Jersey, 2003.
3. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
4. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2016.
5. Viswanandham, "Performance Modeling of Automated Manufacturing Systems", Prentice Hall of India,1st edition, 2009.
6. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
7. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson New International, 2013.
8. Deb. S. R. "Robotics technology and flexible automation", Tata McGraw Hill publishing company limited, 1994
9. Lukas M.P, " Distributed Control Systems", Van Nostrand Reinhold Co., New York, 1986.
10. N. Viswanandham, Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", 1st Edition, 2009.
11. Krishna Kant, "Computer - Based Industrial Control", 2nd Edition, Prentice Hall, New Delhi, 2011.

BTEI-908C-18	Credits	L	T	P	Int	Ext
Machine Vision	3	3	0	0	40	60

Course Objective: The principle objective of the syllabus is to give an introduction to basic concepts and methodologies for Machine Vision. The students are expected to develop a foundation that can be used as the basis for further study and research in this field. The syllabus gives great emphasis on basic principles as well as more advanced techniques for image processing

Course Outcomes:
After completion of the course, the students would able to:

1. Know the required gadgets of vision systems
2. Understand the image capturing and processing techniques
3. Ability to apply the vision system in other machines
4. Recognize the objects.
5. Understand the applications of vision and image processing in robot operations.

Unit I: Vision in Humans & Machines and Image Processing
Introduction: Machine Vision, Relationship to other fields, Image – Definition and Geometry, Levels of Computation, Active Vision System, Machine Vision Components, Humans & Machines: Visual System Machines, Visual Perception, Color perception, Image Processing: Nature of images, homogeneous transformations, image acquisition, Image characterization, Sampling & quantization, Spatial, Filtering, edge detection, features detection, contours, segmentation, Binary Image Processing: Thresholding, Geometric properties, Run length encoding.

Unit II: Calibration and Vision Algorithms
Calibration: Camera model, intrinsic and extrinsic camera parameters, camera calibration. Vision Algorithms: Fundamental Data Structures: Images, Regions, Sub-pixel Precise Contours – Image Enhancement : Gray value transformations, image smoothing, Fourier Transform – Geometric Transformation – Image segmentation – Segmentation of contours, lines, circles and ellipses – Camera calibration – Stereo Reconstruction. Texture & Analysis.

Unit III: Object Recognition, Motion and Three Dimensional Imaging - Object recognition: Approaches to Object Recognition, Recognition by combination of views – objects with sharp edges, using two views only, using a single view, Complexity of object Recognition, Feature detection, recognition strategies, Motion: Motion detection, optical flow, object tracking, motion capture. Three-dimensional imaging: Epipolar geometry, stereoscopic vision, active range imaging, structured lighting.

Unit IV: Industrial Machine Vision - Industrial machine vision in production and services, structure of industrial m/c vision, generic standards, rules of thumb, illumination, optics, image processing, interfacing machine vision system, vision system calibration

Unit V: Robot Vision - Basic introduction to Robotic operating System (ROS) – Real and Simulated Robots – Introduction to OpenCV, Open NI and PCL, installing and testing ROS camera Drivers, ROS to OpenCV – The cv_bridge Package.

Recommended Books:

1.Carsten Steger, Markus Ulrich, Christian Wiedemann, Machine Vision Algorithms and Applications, WILEY-VCH, Weinheim,2008.
2.E. Trucco & A. Verri,"Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998
3.Ramesh Jain, Rangachar Kasturi, Brian G. Schunck, Machine Vision , McGraw-Hill, Inc.
4.Shimon Ullman, High-Level Vision: Object recognition and Visual Cognition, A Bradford Book, USA, 2000.
5.Rafael C. Gonzalez and Richard E.woods, Digital Image Processing, Addition – Wesley Publishing Company, New Delhi, 2007.
6.Bershold Klaus, Paul Holm, "Robot vision", The MIT press.

BTEI-908D-18	Credits	L	T	P	Int	Ext
Embedded Systems	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.

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.

Professional Electives – 5

BTEI-909A-18	Credits	L	T	P	Int	Ext
Neural Networks and Fuzzy Systems	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 Neural Networks and Fuzzy systems.

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-602-18	Credits	L	T	P	Int	Ext
Wireless Sensor Networks	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to understand the important concepts related to Wireless Sensor Networks.

Course Outcomes

At the end of the course the students will be able to
1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

Unit 1: Introduction to Sensor Networks - Unique constraints and Challenges of Sensor Networks, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Unit 2: Mobile Ad-hoc Networks – Significance of Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Unit 3: Routing protocols - MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Unit 4: Design Principles for WSNs - Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science

BTEI-909B-18	Credits	L	T	P	Int	Ext
Smart Sensors & Networking	3	3	0	0	40	60

Course Outcomes

At the end of this course students will demonstrate the ability to:
1. Describe the principle of smart sensors and process of micromachining in development of smart sensors.
2. Develop intelligent systems by interfacing the smart sensors to MCUs and DSPs
3. Learn key routing protocols for sensor networks.
4. Analyze the use of smart sensors in communication, MEMS and automation.

Unit 1: Smart Sensor - Basic of Smart Sensor, Types & nature of smart Sensors, Functions, Actuators, Different Inputs and Outputs Devices, Smart Sensor Networks & its Architecture

Unit 2: Sensor Communication and MEMS - Wireless zone sensing, surface acoustical wave devices, intelligent transportation system, RF-ID, Micro optics, micro-grippers, micro-probes, micro- mirrors, FEDs, communications for smart sensors – sources and standards, automotive protocols, industrial networks, office and building automation, home automation, protocols in silicon, other aspects of network communications.

Unit 3: Sensor Interfaces - Signal processing, Multi sensor signal processing, Smart Sensors, Interface Systems.

Unit 4: Designing in Sensor Networking - Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Unit 5: Unit Standards for Smart Sensors - Introduction, setting the standards for smart sensors and systems, IEEE 1451.1, IEEE 1451.2, IEEE P1451.3, IEEE 1451.4, extending the systems to network.

Recommended Books:

1. Understanding Smart Sensors- Randy Frank, 2nd Edition. Artech House Publications, 2013.
2. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre, Micro and Smart Systems: Technology and modeling, Willey Publications,2012.
3. Nitaigour p. mahalik, Sensor networks and configuration fundamentals, standard, platforms and application. Springer verlag berline, English, Is ted. Nov 2006.
4. S. middelhoer & A.C. Hoogerwerf, “Smart Sensors When & Where”, Sensors and Actuators,1995.
5. Sensors and Actuators – D. Patranabis – 2nd Ed., PHI, 2013.

BTEI-909C-18	Credits	L	T	P	Int	Ext
Sensors for Engineering Applications	3	3	0	0	40	60

Course Outcomes

At the end of the course the students will be able to

1. Explain the principle of Sensors used in Mechanical, Electrical, Thermal and Biomedical fields.
2. Understand the emerging research areas in the field of Sensor characterisation and calibration.
3. Understand sensor Modeling & Technology in various domains.
4. Describe the integration of computation, networking, databases, and various sensors, in order to embed smart sensor systems into actual social systems.

Unit 1: Principles of Sensors - Sensor classification, Sensing mechanism of Mechanical, Electrical, Thermal, Magnetic, Optical and Biological Sensors.

Unit 2: Sensor Characterisation and Calibration - Study of Static and Dynamic Characteristics, Sensor reliability, aging test, failure mechanisms and their evaluation and stability study, Numerical modeling techniques, Model equations, Different effects on modeling (Mechanical, Electrical, Thermal, Magnetic, Optical, Chemical and Biological) and examples of modeling.

Unit 3: Sensor Technology - Thick and thin films fabrication process, Micro machining, IOC (Integrated Optical circuit) fabrication process, Ceramic material fabrication process, Wire bonding, and Packaging.

Unit 4: Sensor Applications - Process Engineering, Batch Processing, Medical Diagnostic and Patient monitoring, Environmental monitoring etc.

Recommended Books:

1. Kyung, C., Yasuura, H., Liu, Y., Lin, Y.-L. (Eds)., "Smart Sensors and Systems", by Springer Publications, 2017.
2. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications ,2011
3. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009.
4. Huang, Yueh-Min Ray (Ed.), "Sensors", by Springer Publications, 2008.

BTEI-909D-18	Credits	L	T	P	Int	Ext
Advanced Sensors	3	3	0	0	40	60

Course Outcomes

At the end of the course the students will be able to

1.Learn about sources and detectors of various types of Sensors for Engineering applications.
2.Explain fundamental knowledge on the basic laws and phenomena involved in Sensors.
3. Describe design techniques for sensor signal conditioning.
4.Understand the transducers input & Output devices along with inductive & capacitive transducer.

Unit 1: Sensors & Transducers for Engineering Applications - Theory and classifications of chemical sensors, biosensors, Fiber optic sensors, gas sensors, Input and output characteristics of various transducers, variable resistance transducer and its equivalent circuit, variable inductance and variable capacitance transducers, their construction and performance, Piezoelectric transducer.

Unit 2: Design techniques for sensor signal conditioning - Sensor and signal conditioning for strain, force, pressure, flow and temperature measurement, Bridge configurations, Amplifying and line arising bridge outputs, Driving bridge circuits.

Unit 3: Positioning, motion and temperature sensors - LVDT, Hall effect magnetic sensors, optical encoders Accelerometer, RTDs, thermistors, thermocouples, semiconductors temperature sensors.

Unit 4: Micro-sensors and smart sensors- General Introduction to Micro-sensors & Smart Sensors, Construction, characteristics, and applications.

Recommeded Books:

1. H.K.P Neubert "Instrument Transducers" Oxford Herman University Press Eighth Impression 2008.
2. R.Pallas, A.Johan, G. Webster "Sensor And Signal Conditioning" John Wiley, NY 1991.
3. Dan Sheingold "Transducer Interfacing Handbook", Analog Devices Inc 1980.
4. J. Fraden "Handbook Of Modern Sensors "2nd Edition ,Springer-Verlag.New York 1996.
5. John P. Bentley, "Principles of Measurement systems" Third edition, Pearson 2000.

Open Elective - 2

(The List of Open Electives (OE) courses offered is provided in the Course Scheme)

Open Elective - 3

(The List of Open Electives (OE) courses offered is provided in the Course 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

i. Basic Structure of Indian Knowledge system
ii. ii. Modern Science and Indian Knowledge system
iii. Yoga and Holistic Health Care

iv. 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

i. Philosophical Tradition
ii. Indian Linguistic Tradition (Phonology, morphology, syntax and semantics)
iii. Indian Artistic Tradition
iv. 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

BTEI-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. Preparing a paper for Conference presentation/Publication in Journals, if possible;
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 incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.