IKG Punjab Technical University

Syllabus (3rd-8th Semester)

for

Undergraduate Degree Programme

Bachelor of Technology

ELECTRONICS AND INSTRUMENTATION ENGINEERING

Scheme & Syllabus

2018 & onwards

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	BTAMXXX18	Mathematics III	3	1	0	4	40	60	100	4
6	BTEC-311-18	Electronic Devices Laboratory	0	0	2	2	30	20	50	1
7	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	**18**	**3**	**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	0	0	3	40	60	100	3
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**	**20**

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-901X-18	Program Elective-1	3	0	0	3	40	60	100	3
6	BTOE-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-902X-18	Program Elective-2	3	0	0	3	40	60	100	3
5	BTOEI-XX2-18	Open Elective-1	3	0	0	3	40	60	100	3
6	BTMC-XXX-18	Mandatory Course Constitution of India	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	BTEC-903X-18	Professional Elective-3	3	0	0	3	40	60	100	3
2	BTEC-904X-18	Professional Elective-4	3	0	0	3	40	60	100	3
3	BTEC-905X-18	Professional Elective-5	3	0	0	3	40	60	100	3
4	BTEC-YYY-18	Open Elective-3	3	0	0	3	40	60	100	3
5	BTEC-ZZZ-18	Open Elective-4	3	0	0	3	40	60	100	3
6	BTMC-XXX-18	Constitution of India (Mandatory Course)	3	0	0	3	40	60	100	Non-credit
7	BTMC-ZZZ-18	Essence of Indian Traditional	3	0	0	3	40	60	100	Non-credit

		Knowledge								
8	BTEC-731-18	Project-II & Report	0	0	12	12	120	80	200	6
9	BTEC-12X-18	Professional Elective 3 or 4 Lab (Optional)	0	0	2	2 Satisfactory/Un-satisfactory				Non-credit
10	BMPD-371-18	Mentoring and Professional Development	0	0	2	2 Satisfactory/Un-satisfactory				Non-credit
		Total	**18**	**0**	**16**	**37**	**400**	**500**	**900**	**24**

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 Softwaare/Industrial Training & Project	300	200	500	16
		Total	**300**	**200**	**500**	**16**
Total Marks including B.Tech. 1st Year			**2580**	**2740**	**5600**	**167**

* 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	BTCS602-18	Computer Networks	3L:0T:0P	3
12.	VII	PE-3	BTEC-906B-18	Satellite Communication	3L:0T:0P	3
13.	VII	PE-4	BTEI-907A-18	PLC, DCS and SCADA	3L:0T:0P	3
14.	VII	PE-4	BTEI-907B-18	Mechatronics	3L:0T:0P	3
15.	VII	PE-4	BTEI-907C-18	Intelligent Robotics	3L:0T:0P	3
16.	VII	PE-4	BTEI-907D-18	Industrial Automation	3L:0T:0P	3
17.	VIII	PE-5	BTEI-908A-18	Machine Vision	3L:0T:0P	3
18.	VIII	PE-5	BTEI-908B-18	Neural Networks and Fuzzy systems	3L:0T:0P	3
19.	VIII	PE-5	BTEI-908C-18	Evolutionary Algorithms	3L:0T:0P	3
20.	VIII	PE-5	BTEI-908D-18	Embedded Systems	3L:0T:0P	3
21.	VIII	PE-6	BTEC-906A-18	Wireless Sensor Networks	3L:0T:0P	3
22.	VIII	PE-6	BTEI-908E-18	Smart Sensors and Networking	3L:0T:0P	3
23.	VIII	PE-6	BTEI-908F-18	Sensors for Engineering Applications	3L:0T:0P	3
24.	VIII	PE-6	BTEI-908G-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

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	2L:10T:0P	3

		and Popular Culture		
15.	HSMC116-18	Universal Human Conduct	2L:10T:0P	3
16.	HSMC117-18	Gender Culture and Development	2L:10T:0P	3
17.	HSMC118-18	Introduction to Women's and Gender Studies	2L:10T:0P	3
18.	HSMC118-18	Introduction to Women's and Gender Studies	2L:10T:0P	3
19.	HSMC119-18	Advance Course in Peace Research	2L:10T:0P	3
20.	HSMC120-18	Contemporary India in Globalized Era: Challenges of Democracy and Development	2L:10T:0P	3
21.	HSMC121-18	Making Indian Culture: Epistemic Traditions, Literature and Per formative Arts	2L:10T:0P	3
22.	HSMC122-18	Universal Human Values 2: Understanding Harmony	2L:10T:0P	3
23.	HSMC123-18	Human relations at work	2L:10T:0P	3
24.	HSMC124-18	Sanskrit Bhasa	2L:10T:0P	3
25.	HSMC125-18	Language and Communication	2L:10T:0P	3
26.	HSMC126-18	Language and Linguistics	2L:10T:0P	3
27.	HSMC127-18	Understanding Society and Culture through Literature	2L:10T:0P	3
28.	HSMC128-18	Fundamentals of Linguistics	2L:10T:0P	3
29.	HSMC128-18	Fundamentals of Linguistics	2L:10T:0P	3
30.	HSMC129-18	Elements of Literature	2L:10T:0P	3
31.	HSMC130-18	Humanities and Multiple Dimensions of Ecology	2L:10T:0P	3
32.	HSMC131-18	Film Appreciation	2L:10T:0P	3
33.	HSMC(MIM-472)	Introduction to Industrial Management	2L:10T:0P	3
34.	HSMC (MIM-480)	Macro Economics	2L:10T:0P	3
35.	HSMC (MIM-578)	Quantitative Methods for Decision Making	2L:10T:0P	3
36.	HSMC (MIM-475)	Economics for Engineers	2L:10T:0P	3
37.	HSMC (MME-301)	Fundamentals of Management for Engineers	2L:10T:0P	3
38.	HSMC (MME-302)	Project Management and Entrepreneurship	2L:10T:0P	3
39.	HSMC (MME-303)	Law and Engineering	2L:10T:0P	3
40.	HSMC (MME-304)	Understanding Interpersonal Dynamics	2L:10T:0P	3

THIRD SEMESTER

B.Tech.

Electronics & Instrumentation Engineering

Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

03/12/2020

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

BTAM-XXX-18	Credits	L	T	P	Int	Ext
Mathematics III	4	3	1	0	40	60

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables along with Probability and Correlation. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

The students will learn:
1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
5. To provide an overview of probability and statistics to engineers

Section A

Unit 1 : Transforms Calculus-I:

Laplace Transform, Properties of Laplace Transform, Laplace Transform of Unit step function, Impulse function, Dirac-delta function, Periodic functions. Inverse Laplace Transform, convolution theorem, Evaluation of integrals by Laplace Transform, Applications to ODEs and PDEs.

Unit 2: Transforms Calculus-II:

Fourier Series, half range Fourier Sine and Cosine series, Fourier integrals, Gibbs Phenomenon, Fourier transforms, Relation between Laplace and Fourier transform, Properties of Fourier Transforms, Convolution Theorem and applications

Unit 3: Transforms Calculus-III

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

Section B

Unit 4: Probability

Conditional probability, Discrete and continuous random variables, Probability distributions: Binomial, Poisson and Normal, Poisson approximation to the binomial distribution, evaluation of statistical parameters for these three distributions.

Unit 5: Correlation and regression

Correlation and Regression for bivariate data, Rank correlation, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance for small and large samples (z-test, t-test, F-test and Chi-square test).

Text / References:

1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
2. R K jain and Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing, 2017.
3. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
4. S. Ross, "A First Course in Probability", Pearson Education India, 2002.
5. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.

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)

03/12/2020

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

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.

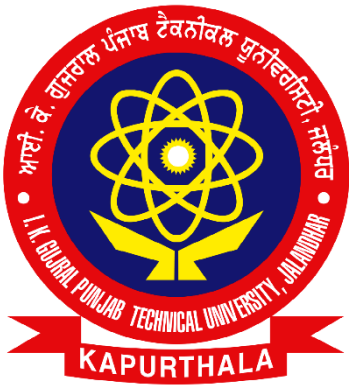
Evaluation shall be based on rubrics for Part – A & B

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)

03/12/2020

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.

BTEC-503-18	Credits	L	T	P	Int	Ext
Linear Integrated Circuits	3	3	0	0	40	60

Course Objective

This is one of the fundamental courses meant to 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)

03/12/2020

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

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.

BTEI-906B-18	Credits	L	T	P	Int	Ext
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.