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	0	0	3	40	60	100	3
3	BTEC- 303-18	Electromagnetic Waves	3	1	0	4	40	60	100	4
4	BTEC-304-18	Network Theory	3	1	0	4	40	60	100	4
5	BTAMXXX18	Mathematics III	3	1	0	4	40	60	100	4
6	BTEC-311-18	Electronic Devices Laboratory	0	0	2	2	30	20	50	1
7	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	2
10	BMPD-331-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit
		Total	**18**	**3**	**10**	**29**	**360**	**440**	**800**	**25**

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	40	60	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**	**330**	**420**	**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	BTEE-702C-18	Digital Control Systems	3	0	0	3	40	60	100	3
2	BTEI-501-18	Biomedical Instrumentation	3	0	0	3	40	60	100	3
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**	**23**

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	0	0	3	40	60	100	3
2	BTEC-502-18	Digital Signal Processing	3	1	0	4	40	60	100	4
3	BTEI-602-18	Data Acquisition and Telemetry	3	0	0	3	40	60	100	3
4	BTEI-902X-18	Program Elective-2	3	0	0	3	40	60	100	3
5	BTOE-XX2-18	Open Elective-2	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**	**20**

Semester VII [Fourth 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-903X-18	Program Elective-3	3	0	0	3	40	60	100	3
2	BTEI-904X-18	Program Elective-4	3	0	0	3	40	60	100	3
3	BTOE-XX3-18	Open Elective-3	3	0	0	3	40	60	100	3
4	BTOE-XX4-18	Open Elective-4	3	0	0	3	40	60	100	3
5	BTMS-YYY18	Project Management & Finance	3	0	0	3	40	60	100	3
6	BTEI-731-18	Project Stage-I	0	0	4	4	60	40	100	2
7	BTEI-841-18	Seminar	0	0	2	2	100	0	100	1
8	BTEI-721-18	4-Week Industrial Training-II	0	0	6	6	60	40	100	3
9	BMPD-371-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit
		Total	**15**	**0**	**14**	**27**	**420**	**380**	**800**	**21**

Semester VIII [Fourth 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- 905X-18	Program Elective-5	3	0	0	3	40	60	100	3
2	BTEI-906X-18	Program Elective-6	3	0	0	3	40	60	100	3
3	BTOE-XX5-18	Open Elective-5	3	0	0	3	40	60	100	3
4	BTOE-XX6-18	Open Elective-6 (Humanities)	3	0	0	3	40	60	100	3
5	BTEI-831-18	Project Stage-II & Report	0	0	12	12	40	60	100	6
6	BTMC-YYY-18	Mandatory Course Essence of Indian Traditional Knowledge	2	0	0	2	40	60	100	Non-credit
7	BMPD-381-18	Mentoring and Professional Development	0	0	2	Satisfactory/Un-satisfactory				Non-credit
		Total	**14**	**0**	**14**	**26**	**340**	**300**	**700**	**18**
Grand Total (including 1st Year)							**2520**	**3000**	**5600**	**165**

* 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]

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-2	BTEE-602C-18	Electrical Drives	3L:0T:0P	3
5.	VI	PE-2	BTEC-902B-18	CMOS Design	3L:0T:0P	3
6.	VI	PE-2	BTEE-602A-18	Industrial Electrical Systems	3L:0T:0P	3
7.	VI	PE-2	BTEC-902D-18	Fuzzy Logic and Systems	3L:0T:0P	3
8.	VI	PE-2	BTEE-701A-18	Power system protection	3L:0T:0P	3
9.	VII	PE-2	BTEC-902F-18	Principles of VLSI Design	3L:0T:0P	3
10.	VII	PE-3	BTEC-903A-18	Linear Integrated Circuits	3L:0T:0P	3
11	VII	PE-3	BTEI-907A-18	Process Dynamics & Control	3L:0T:0P	3
12.	VII	PE-3	BTEC-903C-18	Neural Networks	3L:0T:0P	3
13.	VII	PE-3	BTEC-901B-18	Random Variables and Stochastic processes	3L:0T:0P	3
14.	VII	PE-3	BTEI-907B-18	Process Control & Instrumentation	3L:0T:0P	3
15.	VII	PE-3	BTEC-903F-18	Analytical Instrumentation	3L:0T:0P	3
16.	VII	PE-4	BTEE-501-18	Power systems I- Apparatus & Modelling	3L:0T:0P	3
17.	VII	PE-4	BTEC-904D-18	Wireless Sensor Networks	3L:0T:0P	3
18.	VII	PE-4	BTEC-904E-18	Mixed Signal Design	3L:0T:0P	3
19.	VII	PE-4	BTEC-904F-18	Sensors and Transducers	3L:0T:0P	3
20.	VII	PE-5	BTEC-905A-18	Computer Architecture	3L:0T:0P	3
21.	VII	PE-5	BTEC-905D-18	Internet of Things	3L:0T:0P	3
22.	VII	PE-5	BTEC-905E-18	Mechatronics	3L:0T:0P	3
23.	VIII	PE-6	BTEC-906A-18	Embedded Systems	3L:0T:0P	3
24.	VIII	PE-6	BTEC-906B-18	Nano Electronics	3L:0T:0P	3
25.	VIII	PE-6	BTEE-601-18	Power systems II- Operation and Control	3L:0T:0P	3
26.	VIII	PE-6	BTEC-906E-18	Bio-Medical Electronics	3L:0T:0P	3

LIST OF OPEN ELECTIVE (OE) COURSES FOR STUDENTS OF OTHER PROGRAMS

Sr. No.	Course Code	Sem	Course Title	L	T	P	Hours/ Week	Credits
1.	BTEC-303-18	V	Digital System Design	3	0	0	3	3
2.	BTEC-402-18	VI	Microprocessors and Microcontrollers	3	0	0	3	3
3.	BTEC-401-18	VII	Analog Circuits	3	0	0	3	3
4.	BTEI-501-18	VIII	Biomedical Instrumentation	3	0	0	3	3
5.	BTEI-602-18	VIII	Data Acquisition and Telemetry	3	0	0	3	3
6.	HSMC (MME-301)/ HSMC (MME-475)	VIII	Fundamentals of Management for Engineers/ Economics for Engineers	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

List of Humanities & Social Sciences Including Management

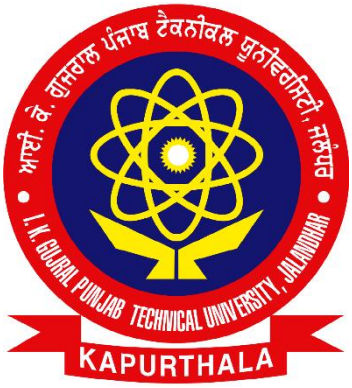
Sr. No.	Course Code	Course Title	Hours	Credits
1.	HSMC101-18 /HSMC102-18	Foundational Course in Humanities (Development of Societies/Philosophy)	2L:10T:0P	3
2.	HSMC103-18	Education, Technology and Society	2L:10T:0P	3
3.	HSMC104-18	History of Science and Technology in India	2L:10T:0P	3
4.	HSMC105-18	Nyaya Logic Epistemology	2L:10T:0P	3
5.	HSMC106-18	Political and Economic Thought for a Humane Society	2L:10T:0P	3
6.	HSMC107-18	State, Nation Building and Politics in India	2L:10T:0P	3
7.	HSMC108-18	Psychological Process	2L:10T:0P	3
8.	HSMC109-18	Positive Psychology	2L:10T:0P	3
9.	HSMC110-18	Application of Psychology	2L:10T:0P	3
10.	HSMC111-18	Sociology, Society and Culture	2L:10T:0P	3
11.	HSMC112-18	Epochal Shift	2L:10T:0P	3
12.	HSMC113-18	Values and Ethics	2L:10T:0P	3
13.	HSMC114-18	Ethics and Holistic Life	2L:10T:0P	3
14.	HSMC115-18	Folk and Vernacular Expressive Tradition and Popular Culture	2L:10T:0P	3
15.	HSMC116-18	Universal Human Conduct	2L:10T:0P	3
16.	HSMC117-18	Gender Culture and Development	2L:10T:0P	3
17.	HSMC118-18	Introduction to Women's and Gender Studies	2L:10T:0P	3
18.	HSMC118-18	Introduction to Women's and Gender Studies	2L:10T:0P	3
19.	HSMC119-18	Advance Course in Peace Research	2L:10T:0P	3
20.	HSMC120-18	Contemporary India in Globalized Era: Challenges of Democracy and Development	2L:10T:0P	3
21.	HSMC121-18	Making Indian Culture: Epistemic Traditions, Literature and Per formative Arts	2L:10T:0P	3
22.	HSMC122-18	Universal Human Values 2: Understanding Harmony	2L:10T:0P	3
23.	HSMC123-18	Human relations at work	2L:10T:0P	3
24.	HSMC124-18	Sanskrit Bhasa	2L:10T:0P	3
25.	HSMC125-18	Language and Communication	2L:10T:0P	3
26.	HSMC126-18	Language and Linguistics	2L:10T:0P	3
27.	HSMC127-18	Understanding Society and Culture through Literature	2L:10T:0P	3
28.	HSMC128-18	Fundamentals of Linguistics	2L:10T:0P	3
29.	HSMC128-18	Fundamentals of Linguistics	2L:10T:0P	3
30.	HSMC129-18	Elements of Literature	2L:10T:0P	3
31.	HSMC130-18	Humanities and Multiple Dimensions of Ecology	2L:10T:0P	3
32.	HSMC131-18	Film Appreciation	2L:10T:0P	3
33.	HSMC(MIM-472)	Introduction to Industrial Management	2L:10T:0P	3
34.	HSMC (MIM-480)	Macro Economics	2L:10T:0P	3
35.	HSMC (MIM-578)	Quantitative Methods for Decision Making	2L:10T:0P	3

36.	HSMC (MIM-475)	Economics for Engineers	2L:10T:0P	3
37.	HSMC (MME-301)	Fundamentals of Management for Engineers	2L:10T:0P	3
38.	HSMC (MME-302)	Project Management and Entrepreneurship	2L:10T:0P	3
39.	HSMC (MME-303)	Law and Engineering	2L:10T:0P	3
40.	HSMC (MME-304)	Understanding Interpersonal Dynamics	2L:10T:0P	3

THIRD SEMESTER

B.Tech.

Electronics & Instrumentation Engineering



Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

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

Course Objective

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

Course Outcomes

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

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

Unit 1: Semiconductor Physics

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

Unit 2: Diodes

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

Unit 3: Transistors

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

Unit 4: Fabrication Processes

Oxidation; diffusion; ion-implantation; photolithography; etching; chemical vapor deposition; sputtering; twin-tub CMOS process.

Recommended Books

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

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

Course Objective

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

Course Outcomes

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

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

Unit 1: Measurement Systems

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

Unit 2: Basic Parameter Measurements

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

Unit 3: Oscilloscopes

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

Unit 4: Instruments for Generation and Analysis of waveforms

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

Recommended Books

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

BTEC-303-18	Credits	L	T	P	Int	Ext
Electromagnetic Waves	3	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	3	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

To be finalized by the Department of Mathematical Sciences

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

Course Objective

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

Course Outcomes

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

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

Part-A: Experiments

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

Part-B: Lab Projects

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

1. Blinking linear/circular lights
2. Ambient light sensor based controller
3. Regulated dual power supply of ±5V or ±12V or mixed
4. BJT audio amplifier
5. BJT circuit for sampling of analog signal
6. Simulate any project idea using SPICE software

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

Course Objective

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

Course Outcomes

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

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

Part-A: Experiments

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

Part-B: Lab Projects

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

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

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

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

BTEI-321-18	Credits	L	T	P	Int	Ext
4-Week Institutional Training	4	0	0	8	60	40

Four weeks training in the area of Electronics and Communication Engineering. This training should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her.

BMPD-331-18	Credits	L	T	P	Int	Ext
Mentoring and Professional Development*	Non-credit	0	0	2	S/US**	

* As stated in the IKGPTU B.Tech 1st Year Scheme and Syllabus
**S/US - Satisfactory and Unsatisfactory

* Guidelines regarding Mentoring and Professional Development
The objective of mentoring will be development of:
- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

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

Part – A
(Class Activities)

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

Part – B
(Outdoor Activities)

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

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

FOURTH SEMESTER

B.Tech.

Electronics & Instrumentation Engineering

Syllabus

IKGujral Punjab Technical University

Jalandhar-Kapurthala Highway, Kapurthala-144603 (PB)

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

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	3	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	3	3	0	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; 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.

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

To be finalised by the concerned Board of Studies.

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-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.