Curriculum for Undergraduate Degree (B.Tech.) in Electronics and Communication Engineering (w.e.f. AY: 2020-21)

Part III: Detailed Curriculum

Induction Program (Mandatory)
[Induction program for students to be offered right at the start of the first year.]
3 Weeks Duration
• Physical activity • Creative Arts • Universal Human Values • Visits to local Areas • Literary • Proficiency Modules • Lectures by Eminent People • • Familiarization to Dept./Branch & Innovations
Please refer **Appendix-A** for AICTE guidelines on Mandatory Induction Program.

First Semester

Course Name:	**Physics**		
Course Code:	BS-PH101	**Category:**	Basic Science Course
Semester:	First	**Credit:**	4.0
L-T-P:	3-1-0	**Pre-Requisites:**	Mathematics course with vector calculus
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Understand the basic concepts of Electricity and Magnetism and comprehend their uses in real life situations.
2	Understand the formulations of Quantum Mechanics and its applications to modern technologies.
3	Describe the working principle of LASER and their applications to communication systems such as Optical Fiber.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Module-1: Foundations of Quantum Mechanics**	**(8L)**
	Introduction to Quantum Physics: Brief idea about the historical development of quantum mechanics.	1
	Black Body Radiation: Planck's Hypothesis and derivation of Planck's Radiation formula, Limiting case of Planck's radiation law: Wien's Radiation Law & Rayleigh Jean's law, Stefan's Boltzmann law & Wien's Displacement law (no derivation), Numerical problems with applications of radiation laws.	2
	Compton Effect: Experimental observation of Compton effect, Derivation of the Compton shift, Modified and Unmodified lines, Estimation of the energy of the scattered radiation and energy of recoiled electron, Numerical problems.	2
	Wave-Particle Duality: de Broglie hypothesis, Wave-particle duality, Calculation of de Broglie wavelength, Verification of matter waves by Davisson and Germer experiment, Concept of phase velocity and group velocity and their inter-relation.	2
	Uncertainty Principle: Heisenberg's uncertainty principles (no derivation) for motion of microscopic particles, Nonexistence of electrons within nucleus, Zero point energy, Numerical problems.	1
2	**Module-2: Schrödinger Wave Equation and Its Applications**	**(8L)**
	Formulation of Quantum Mechanics: Postulates of Quantum Mechanics, Concept of operators and their Eigen values, Wave function and its physical significance, Expectation value of an observable quantity, Discussion of associated problems.	3
	Schrödinger Wave Equation: Time independent Schrödinger's equation from time dependent one by the separation of variable method.	1
	Applications of Quantum Mechanics: Solution of Schrödinger's time-independent equation for a free particle in an infinite potential well (1D & 3D box), Associated theoretical and numerical problems, Concept of degeneracy and non-degeneracy of a particle enclosed in a 3D box, Concept of quantum mechanical tunneling and quantum harmonic oscillator	4
3	**Module-3: Dielectric Materials and their Applications**	**(5L)**
	Concept of Dielectric and Polarization: Electric field inside a Dielectric, Electric dipole and dipole moment, Polar and non-polar dielectrics, Influence of electric field on non-polar and polar molecules, Atomic polarizability and polarization vector.	1
	Inter Relationship among Dielectric Parameters: Concept of surface and volume bound charges, Gauss' law in presence of dielectric, Derivation of relation among electric field, polarization and displacement vector, Concept of susceptibility, permittivity and dielectric constant in linear dielectrics, Problems on relation between polarizability, susceptibility and dielectric constant.	2
	Types of Polarization: Electronic polarization and derivation of electronic	1

	polarizability, Concept of ionic and orientational polarization (no derivation). ***Applications of Dielectric:*** Dielectric breakdown and dielectric strength, Concept of Dielectric loss, Few applications of dielectrics in different fields.	1
4	**Module-4: Time Varying Fields** ***Electromagnetic Induction:*** Faraday's law of electromagnetic induction, Integral & differential form of Faraday's law, Application of Faraday's law in Motors and Generators, Calculation of Induced EMF. ***Displacement Current:*** Ampere's law: integral & differential forms, Inconsistency of Ampere's law, Maxwell's modification, Concept and characteristics of displacement current.	**(3L)** 2 1
5	**Module-5: Electromagnetic Waves** ***Maxwell's Electromagnetic Field Equations:*** Maxwell's equations in differential & integral forms, Physical significances, Maxwell's equations under different conditions (free space, good conductor, perfect insulators etc.). ***Plane Electromagnetic Wave in Free Space:*** Wave equations in free space, Estimation of velocity of the EM wave in free space, Concept of transverse nature of electromagnetic waves. ***Plane Electromagnetic Wave in Medium:*** Wave equations in non-conducting and conducting media, Calculation of skin depth, Estimation of magnitude and direction of electric/magnetic field. ***Energy in an Electromagnetic Field:*** Flow of energy associated to electromagnetic field and Poynting vector.	**(6L)** 2 1 2 1
6	**Module-6: Laser and Fiber Optics** ***Introduction to Laser:*** Properties of light sources, Need of suitable light source in communication, Invention of laser, Characteristics and applications of laser. ***Interaction of Light with Matter:*** Stimulated absorption, spontaneous emission and stimulated emission of radiation, Transitions probabilities, Einstein's A and B coefficients and the inter-relationship among them. ***Components and Working of Laser Systems:*** Necessary conditions for lasing action, Metastable energy state, Population inversion, Amplification by optical cavity resonator, Design of resonator to ensure single longitudinal mode operation, Working principle of solid-state lasers (ruby laser and Nd:YAG laser) and gas lasers (He-Ne laser & CO_2 laser). ***Optical Communication:*** Introduction, Need for optical communication, Salient features of optical fibers, Amplitude and digital modulation, Estimation of number of speech signals to be sent simultaneously through specific bandwidth analog/digital communication system ***Light Guidance in Fibers:*** Ray theory of light guidance, Relative refractive index difference and numerical aperture, Concept of modes of a fiber, Single and multimode fibers, Step-index and graded-index fibers. ***Transmission characteristics of optical fibers:*** Attenuation, Rayleigh scattering, Pulse broadening mechanism, Estimation of intermodal dispersion,	**(9L)** 1 1 2 2 1 2

	bit rate - length product, Minimization of intermodal dispersion.	
Total		**39L**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Differentiate between different dielectric materials depending on their dielectric strength, breakdown voltage, losses and apply them to real life problems.
2	Apply the concepts of Faraday's law to analyze mechanisms of electromagnetic breaking and solve problems on induced EMF for motors, generators etc.
3	Solve for electric field, magnetic field & power flow using Maxwell's equations and analyze various medium of propagations.
4	Understand the concept of black body radiation and predict its temperature from the spectrum, and comprehend the particle nature of light using Compton Effect, existence of matter waves.
5	Describe the basic formulations of Quantum Mechanics such as the concept of operators, wave function and their evolution using Schrödinger equation and apply them to understand the workings of devices like Tunnel Diode, Scanning Tunnelling Microscopy etc.
6	Explain the workings of various LASERs and their uses especially in optical fiber communication. Illustrate the concept of modes of an optical fiber and estimate the dispersion leading to calculation of Bit Rate of a communication channel..

Learning Resources:	
1	'Introduction to Quantum Mechanics' by David J. Griffiths
2	'Quantum Mechanics' by Leonard I. Schiff
3	'Quantum Physics' by A. N. Konar
4	'Perspectives of Modern Physics' by Aurther Beiser
5	'Introduction to Electrodynamics' by David J. Griffiths
6	'Electrical Engineering Materials' by A. J. Dekker
7	'Fundamentals of Optics' by Jenkins and White
8	'Lasers, theory and applications' by K. Thyagrajan and A. Ghatak
9	'Understanding Lasers' by Jeff Hecht
10	'An Introduction to Fiber Optics' by Ajoy Ghatak and K. Thyagrajan

Course Name:	**Mathematics-I**		
Course Code:	BS-M101	**Category:**	Basic Science Courses
Semester:	First	**Credit:**	04
L-T-P:	3-1-0	**Pre-Requisites:**	High School Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To know Convergence of sequence and series
2	To know Limit, continuity and partial derivatives, Chain rule, Implicit function
3	To know the uses of matrix in different areas in engineering
4	To know the use of mean value theorems in engineering fields
5	Use of vector functions in different fields of Engineering

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Determinants and Matrices:** (i) Introduction to determinant, properties (proofs of identities are excluded). (ii) Types of matrices, rank of a matrix, inverse of a matrix, Linear systems of equations, Cramer's rule, eigen-values and eigen-vectors, Caley-Hamilton theorem.	**6L**
2	**Differential Calculus (Function of single variable):** (i) Indeterminate forms and L'Hospital's rule; Successive differentiation, Leibnitz's theorem. (ii) Rolle's theorem, Lagrange's mean value theorem, Taylor's and Maclaurin theorems with remainders; Maxima and minima. (iii) Evolutes and Involutes.	**6L**
3	**Differential Calculus (Function of multi-variables):** (i) Concept of limit, continuity and partial differentiation, chain rule, total differential, Jacobian, Euler's theorem on homogeneous function. (ii) Hessian, Maxima and minima; Lagrange's multipliers.	**8L**
4	**Integral Calculus:** (i) Line integrals; double integrals, change of order; triple integrals. (ii) Evaluation of surface areas and volumes of revolutions.	**6L**
5	**Vector Calculus:** (i) Vector differential operator, scalar and vector point function, gradient, directional derivative, divergence and curl. (ii) Divergence theorem, Green's and Stoke's theorem (Statements only) and applications.	**8L**
6	**Sequence and Series:** (i) Sequence, type of a sequence. (ii) Series of positive terms; Geometric and p-series and their convergence criterion; Convergence test of series: Comparison test, D'Alembert's rati test, Cauchy's root test. (iii) Alternating series; Absolute convergence, Leibnitz's theorem.	**6L**
Total		**40**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Apply knowledge of differential and integral calculus to determine curvature and evaluation of different types of improper integrals
2	Utilize mean value theorems for solution of engineering problems.
3	Learn matrices, concept of rank, methods of matrix inversion and their applications.
4	Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.
5	Determine eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces to solve physical and engineering problems
6	Solve multiple integrals and utilize it to different physical problems

Course Name:	**Basic Electrical and Electronics Engineering**		
Course Code:	ES-EE101	**Category:**	ES
Semester:	First	**Credit:**	4
L-T-P:	4-0-0	**Pre-Requisites:**	Knowledge of Class XII level Physics & Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Group A: Basic Electrical Engineering

Course Objectives:	
1	To provide comprehensive idea about AC and DC circuit analysis
2	To make the students understand about working principals and applications of electric machines
3	To make the students understand the components of low voltage electrical installations
4	To provide basic idea about general structure of electrical power system.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
Module 1	**DC Circuits** Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton theorems, maximum power transfer theorem.	**5**

Module 2	**AC Circuits** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel),	4
Module 3	**Three phase system** Generation of three-phase AC power, Three-phase balanced circuits, voltage and current relations in star and delta connections. Relationship between line and phase quantities.	2
Module 4	**DC Machines** Construction, EMF equation, Principle of operation of DC generator, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor	5
Module 5	**AC Machines** **Transformers** Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency **Three-phase induction motor** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor.	4
Module 6	**Electrical Installations** Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.	3
Module 7	**General structure of electrical power system**: Power generation to distribution through overhead lines and underground cables with single line diagram	1
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2	Analyze the steady state behavior of single phase and three phase AC circuits.
3	Illustrate the working principles of DC machines, transformer as well as induction motor and employ them in different area of applications.
4	Describe the components of low voltage electrical installations.
5	Describe the general structure of electrical power system.

Learning Resources:	
1	D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, 2010.
2	C.L. Wadhwa, Basic Electrical Engineering, New Age, 2007.
3	S K Bhattacharya, Basic Electrical and Electronics Engineering, Pearson, 2011
4	Ashfaq Husain and Haroon Ashfaq, Fundamentals of Electrical Engineering, Dhanpat Rai & Co., Delhi, 2007.
5	J.B. Gupta, Basic Electrical Engineering, Kataria& Sons, 2015.
6	L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
7	E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Group B: Basic Electronics Engineering

Course Objectives:	
1	To make the students understand about the semiconductor.
2	To make the students understand about Diode and its circuit.
3	To make the students understand about different Transistors.
4	To make the students understand about the basics of OPAMP and digital electronics.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1.	***Introduction to Semiconductors:*** Energy band theory, Fermi levels: Conductors, Semiconductors and Insulators: electrical properties, band diagrams, intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers, mass action law.	5
2	***Diode and Diode Circuits:*** Formation of P-N junction,depletion region, built-in-potential, forward and reverse biased P-N junction, energy band diagrams,V-I characteristics, Zener diode forward and reverse characteristics, Avalanche breakdown andzener breakdown., junction capacitance and varactor diode**.** Simple diode circuits, load line, linear piecewise model; rectifiers: half wave, full wave, PIV, ripple factor, efficiency**.**	4 3
3	***Introduction to Bipolar Junction Transistor(BJT) and Field Effect Transistor (FET):*** Formation of PNP / NPN junctions, schematic symbols, current components in BJT, energy band diagram, transistor mechanism and principle of operation, CE, CB, CC configuration and characteristics, cut-off, active and saturation mode, early effect. Qualitative discussion on BJT as an amplifier**.** JFET (N channel only)structure, Drain and Transfer characteristics.	4 2

4	***Introduction to OPAMP and Digital Electronics:*** Introduction to Operational Amplifiers: Characteristics, Inverting and Non-Inverting mode of operation, summing amplifier, difference amplifier. Introduction to binary number; Basic Boolean algebra; Introduction to integrated circuits, Logic gates and truth tables for different logic operations and simple digital circuits using the basic gates.	3 3
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	identify semiconductor materials, draw band-diagrams, distinguish between intrinsic and extrinsic semiconductors, n- and p- type semiconductors, calculate drift and diffusion current components
2	explain the junction properties and the phenomenon of rectification, draw the I-V characteristics and identify operating points; Calculate ripple factors, efficiency of power supplies.
3	draw and explain the I-V characteristics of BJTs and FET – both input and output;
4	understand basics of OPAMP and learn the use of it as amplifier.
5	Explain binary numbers and identify different logic gates and circuit implementation.

Learning Resources:	
1	Rakshit and Chattopadhyay: Introduction to Electronics Principle
2	Malvino: Electronic Principle.
3	Millman &Halkias: Integrated Electronics.
4	Boyelstad &Nashelsky: Electronic Devices & Circuit Theory.

Course Name:	**English**		
Course Code:	HM-HU101	**Category:**	HM
Semester:	First	**Credit:**	2
L-T-P:	2-0-0	**Pre-Requisites:**	Students must have basic knowledge of English Language.
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To develop Technical Communication Skills (speaking, reading and writing).

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1.	**TECHNICAL COMMUNICATION**: Theory of Communication – Definition, Scope & Barriers of Communication. Different Communication Models Effective Communication (Verbal / Non-verbal) Presentation / Public Speaking Skills	1L
2	**VOCABULARY BUILDING**: Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, homonyms and standard abbreviations: Acronyms	1L
3.	**BASIC WRITING SKILLS**. Arranging paragraphs & Sentences in logical order Creating Cohesion. Organizing principles of paragraphs in documents. Techniques for writing precisely. Importance of proper punctuation. Creating coherence: Arranging paragraphs & Sentences in logical order.	1 L
4	**GRAMMAR**: Sentence Structures & Types: Simple, Compound, Complex. Use of phrases and clauses in sentences. Transformation of sentences. Articles, Prepositions, Tense, Voice, Narration. Identifying Common Errors in Writing. Subject-verb agreement. Noun-pronoun agreement. Misplaced modifiers. Redundancies. Clichés.	9 L
5	**WRITING PRACTICES**: Teaching all varieties of Technical Reports, Précis Writing, Essay Writing, Business Letters, Cover Letter & CV; E-mail, Memo, Notice, Agenda, Minutes.	10 L
6.	**READING COMPREHENSION**: Strategies for Reading Comprehension, Practicing Technical & Non-Technical Texts, both Seen (3 texts) and Unseen.	2L
Total		**24L**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Acquire basic proficiency in English including reading comprehension, writing and speaking skills. Write grammatically correct English.
2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
3	Acquire linguistic competence necessarily required in various life situations.
4	Develop intellectual, personal and professional abilities.

Learning Resources:	
1.	Practical English Usage. Michael Swan. OUP. 1995.
2.	Remedial English Grammar. F.T. Wood. Macmillan.2007

3.	On Writing Well. William Zinsser. Harper Resource Book. 2001
4.	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5.	Universal English. Prof. Prasad Kataria Publications, 2019.
6.	"Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
7.	Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019. Course Outcomes The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Name:	**Physics Laboratory**		
Course Code:	BS-PH191	**Category:**	Basic Science Courses
Semester:	First	**Credit:**	1.5
L-T-P:	0-0-3	**Pre-Requisites:**	
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	Apply the concepts of physics to carry out experiments on Quantum physics, EMT, Optics and General properties of matter and interpret the same for deduction of results.

Course Contents: (Choose 10 experiments from the following)		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Determination of Dispersive Power of the Material of a Prism	**3P/ week**
2	Determination of wavelength of a monochromatic light by Newton's ring	
3	Determination of Wavelength of the Given LASER Light by Diffraction Method	
4	Determination of Thermo-electric Power of a given Thermocouple	
5	Determination of Specific Charge (e/m) of Electron by J. J. Thompson's Method	
6	Determination of Hall Coefficient of a Semiconductor	
7	Study of Current Voltage Characteristic, Load Response, Areal Characteristic and Spectral Response of a Photovoltaic Solar Cell	
8	Determination of Unknown Resistance using Carey Foster's Bridge	
9	Determination of Planck Constant using Photocell	
10	Verification of Bohr's Atomic Orbital Theory Through Frank-Hertz Experiment	
11	Determination of Rydberg Constant by Studying Hydrogen Spectrum	
12	Determination of Band Gap of a Semiconductor by Four Probe Method	

13	Determination of Young's Modulus of Elasticity of the Material of a Bar by the Method of Flexure	
14	Determination of Rigidity Modulus of the Material of a Wire by Dynamic Method	
15	Determination of Coefficient of Viscosity by Poiseulle's Capillary Flow Method	
Total		**39P**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Examine various semiconductor properties (Hall coefficient, Band gap) and relate the same to the theoretical laws they have learnt.
2	Analyze various solar cell properties to get an idea of optimized performance.
3	Verify quantization of energy in atoms and calculate the least action.
4	Apply the concept of thermo-emf for thermometric calibration and calculate specific charge for charge characterization and unknown resistances using Wheatstone bridge principle.
5	Compute different fundamental elastic constants & general properties of matter.
6	Apply the concept of interference and diffraction to calculate wavelength of light sources and use lasers in fiber optic communications.

Learning Resources:	
1	An Advanced Course in Practical Physics, by D. Chattopadhyay, P. C. Rakshit
2	A Manual of Practical Engineering Physics and Material Science, by A S Vasudeva
3	A Textbook of Engineering Physics Practical, by Dr. R Das, Dr. R Kumar, C S Robinson & P K Sahu

Course Name:	**Basic Electrical and Electronics Engineering Lab**		
Course Code:	ES-EE191	**Category:**	ES
Semester:	First	**Credit:**	2
L-T-P:	0-0-4	**Pre-Requisites:**	Knowledge of Class XII level Physics & Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Group A: Basic Electrical Engineering Laboratory

Course Objectives:	
1	Provide working knowledge for the analysis of basic DC and AC circuits
2	Measurement of power in three phase system
3	Provide working knowledge on Electric machines.

Course Contents:		
Module No.	**Description of Topic/ Experiment**	**Contact Hrs.**
1	Verification of Circuit Theorem, (a) Thevenin's Theorem (with DC sources only) (b) Norton's Theorem (with DC sources only)	3
2	Calibration of ammeter and Wattmeter.	3
3	Measurement of current, voltage and power in RLC series circuit excited by (single-phase) AC supply.	3
4	Measurement of power in a three phase unbalanced circuit by Two Wattmeter Method	3
5	(a) Open circuit and short circuit test of a single-phase transformer (b) Load test of the transformer and determination of efficiency and regulation	3
6	Determination of Torque –Speed characteristics of separately excited DC motor.	3
Total		**18 P**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Illustrate Thevenin's and Norton's theorems
2	Explain the concept of single phase and three phase AC supply.
3	Identify the parameters of a single phase transformer by open circuit and short circuit test.
4	Demonstrate the different characteristics of separately excited DC motor.

Learning Resources:	
1	Laboratory Manual

Group B: Basic Electronics Engineering Laboratory

Course Objectives:	
1	To make the students familiarize with the electronic tools and components.
2	To make the students understand about p-n junction diode and zener diode characteristics and half wave and full wave rectifiers' performances.
3	To make the students understand about the characteristics of BJT and JFET in different modes of operation of it.
4	To make the students understand about the basics of OPAMP and logic gates.

Course Contents:		
Exp. No.	**Description of Topic**	**Contact Hrs.**
1.	Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc. Familiarisation with measuring and testing equipment like CRO, Signal generators etc.	3
2	a) Study of I-V characteristics of Junction diodes. b) Study of I-V characteristics of Zener diodes.	3
3	Study of Half and Full wave rectifiers with Regulation and Ripple factors.	3
4	a) Study of I-V characteristics of BJTs. for CB configurations b) Study of I-V characteristics of BJTs. for CE configurations	3
5	a) Study of drain characteristics of n-channel Junction Field Effect Transistors. b) Study of OPAMP as inverting and non-inverting amplifiers and determination of gain.	3
6	Study of Logic Gates and realization of Boolean functions using Logic Gates.	3
Total		**18P**

Course Outcomes:	
After completion of the course, students will be able to:	
1	identify different electronic components and can select appropriate tools and/or equipments for performing specific operation.
2	realize the I-V characteristics of a p-n junction diode and a zener diode and will be able to understand the applicability of them in relation to their characteristics.
3	implement half wave and full wave rectifier circuits and can analyse the performance of them.
4	realize the I-V characteristics of BJT in CB and CE configurations and will be able to identify different operating regions of it.
5	realize the I-V characteristics of JFET and will be able to identify different operating regions of it.
6	use OPAMP as amplifier and verify the truth tables of different logic gates.

Learning Resources:	
1	Laboratory Manual

Course Name:	**Engineering Graphics & Design**		
Course Code:	ES-ME191	**Category:**	Engineering Sciences
Semester:	First	**Credit:**	3
L-T-P:	1-0-4	**Pre-Requisites:**	Nil
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To make students aware of importance of engineering drawing and to familiar with the drawing tools and standards.
2	To improve the technical communication skill in the form of communicative drawing for solution of science & engineering problems.
3	To develop ability to apply modern CAD tools in engineering practice

Course Contents:

Module No.	Description of Topic/ Experiment	Contact Hrs.
1	**Introduction to Engineering Drawing**: Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1L+4P
2	**Lettering, Dimensioning, Scales:** Plain scale, Diagonal scale and Vernier Scales.	1L+4P
3	**Geometrical Construction and Curves:** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedean Spiral.	1L+4P
4	**Projection of Points, Lines, Surfaces**: Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1L+4P
5	**Projection of Regular Solids:** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1L+4P
6	**Combination of Regular Solids, Floor Plans:** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1L+4P
7	**Isometric Projections:** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1L+4P

8	**Sections and Sectional Views Of Right Angular Solids:** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1L+4P
9	**Overview of Computer Graphics, Customisation& CAD Drawing:** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1L+4P
10	**Annotations, Layering & Other Functions:** applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2L+8P
11	**Demonstration of A Simple Team Design Project:** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing	2L+8P

	practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	
Total		**13L+52P**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Familiarize with basics of drawing, dimensioning, scales, curves
2	Comprehend the theory of orthographic projection and its applications
3	Prepare and interpret isometric projection
4	Create and modify 2D drawing using AutoCAD software

Learning Resources:	
1	Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6	Corresponding set of CAD Software Theory and User Manuals