SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR - 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2019 - 2020

B. E. (ELECTRONICS ENGINEERING)

Published by
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ISO 9001 : 2015 CERTIFIED ORGANISATION

ABOUT THE DEPARTMENT :

Department of Electronics Engineering was established in 1986 and presently offers a UG programme in Electronics Engineering and PG Programme in M. Tech. (VLSI Design). The National Board of Accreditation; New Delhi has accredited the UG Programme four times in succession in the year 2003, 2007, 2013 & 2017 and PG programme in 2016. It is recognized center for Doctoral programmes of RTM Nagpur University. The students undergo projects and six month internship at various industries and institutes of repute. The department has 16 state of the art laboratories with investment of over Rs. 2 crores. The major software tools include VLSI design, development and verification platforms, such as Mentor Graphics FPGA advantage, COMSOL Multiphysics and Agilent ADS Design Suite. The back end place and route vendor specific tools are Xilinx's Vivado, Altera's Quartus II, Tanner tool, and ORCAD 15.7. The design Platforms includes Virtex 5 Development Platform, Spartan-6 Development Platform and Embedded System Design Storage Oscilloscope, MIC Trainer, Digital Signal Processors, Pattern Generator and logic analyzer, MATLAB, Lab View are also part of the state of the art labs. The Department and faculty consistently organize and deliver Workshops, training programs and guest lectures for students / researchers for up-gradation of their technical skills. There are various technical clubs, formed at the departmental level, in which, students actively participate for various national and international events. Faculty members and students participate in INUP programme at IIT, Powai, Mumbai.

VISION OF DEPARTMENT

Electronics Engineering Department endeavors to facilitate state of the art technical education in the field of electronics engineering by infusing scientific temper in students leading towards research and to grow as centre of excellence in the field of microelectronics.

MISSION OF DEPARTMENT

- To promote quality education through stimulating environment for dissemination of knowledge and technology.
- To impart necessary technical, professional skills with moral and ethical values to enable students for achieving a successful career.
- To develop centre of excellence in the field of microelectronics and its allied areas with continuing education program.
- To foster research and development in collaboration with institutions/industries.

1. PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

Program Objectives

1. To prepare graduates to solve engineering problems exhibiting a foundation in mathematical, scientific and electronics engineering fundamentals.
2. To inculcate an ability to design and develop electronic systems to cater the needs of the society.
3. To instill sense of professional and ethical values, effective communication, teamwork, multidisciplinary approach and lifelong learning to excel in professional career / higher studies.

PROGRAM OUTCOMES

1. **Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution to the solution of complex engineering problems.
2. **Problem analysis :** Identify, formulate, review research literature and analyze complex engineering problems reacting substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions :** Design solutions for complex engineering problems and design system components or process that meet the specified need with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
4. **Conduct investigations of complex problems :** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5. **Modern tool usage :** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability :** Understand the impact of the proffessional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
8. **Ethic :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work :** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. **Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective report and design documentation, make effective presentations and give and receive clear instructions,
11. **Project management and finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage project and in multidisciplinary environments.
12. **Life-long learning :** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES:

1. To understand the basic concepts in Electronics Engineering and apply them to various areas, like Digital & Analog electronics, Communication systems, Signal processing, VLSI and Embedded systems.
2. To apply knowledge of Electronics Engineering to design, analyze evaluate circuits & systems using hardware and software tool, meeting realistic constraints.

TEACHING SCHEME FOR FIRST YEAR (SEMESTER I & II) BACHALOR OF ENGG
GROUP 1: SEMESTER-I/ GROUP 2: SEMESTER-II

Sr. No.	Code	Course	Branches	Hours/week L	T	P	Credits	Maximum Marks: Continual Assessment	End Sem Examination	Total	ESE Duration (Hours)
1.	PHT151	Mechanics	Civil; Industrial	3	1	0	4	40	60	100	03
	PHT152	Oscillations, waves & Optics	Electrical Mechanical								
	PHT153	Semiconductor Physics	Electronics; EDT; Electronics & Comm Computer Science Engg; Information Tech.								
2.	PHP151	Mechanics Lab	Civil; Industrial	0	0	3	1.5	25	25	50	–
	PHP152	Oscillations, Waves & Optics Lab	Electrical Mechanical								
	PHP153	Semiconductor Physics Lab	Electronics; EDT; Electronics & Comm. Computer Science Engg; Information Tech.								
3.	MAT152/ MAT151	Differential Equations, Linear Algebra, Statistics & Probability / Calculus	All Branches	3	0/1	0	3/4	40	60	100	03
4.	MAP151	Computational Mathematics Lab	All Branches	0	0	2	1	25	25	50	–
5.	EET151	Basic Electrical Engineering	All Branches	3	1	0	4	40	60	100	03
6.	EEP151	Basic Electrical Engineering Lab	All Branches	0	0	2	1	25	25	50	–
7.	MET151	Engineering Graphics & Design	All Branches	1	0	0	1	40	60	100	03
8.	MEP151	Engineering Graphics & Design Lab	All Branches	0	0	4	2	50	50	100	–
9.	HUT152	Constitution of India	All Branches	2	0	0	0	–	–	–	–
10.	PEP151	Yoga/Sports	All Branches	0	0	2	0	–	–	–	–
			Total	12	2/3	13	**17.5/18.5**			**650**	

GROUP 2: SEMESTER-I / GROUP 1: SEMESTER-II

Sr. No.	Code	Course	Branches	Hours/week L	T	P	Credits	Maximum Marks: Continual Assessment	Maximum Marks: End Sem Examination	Maximum Marks: Total	ESE Duration (Hours)
1.	CHT151	Chemistry	All Branches	3	1	0	4	40	60	100	03
2.	CHP151	Chemistry Lab	All Branches	0	0	3	1.5	25	25	50	--
3.	MAT151/ MAT152	Calculus / Differential Equations, Linear Algebra, Statistics & Probability	All Branches	3	1/0	0	4/3	40	60	100	03
4.	CST151	Programming for Problem Solving	All Branches	4	0	0	4	40	60	100	03
5.	CSP151	Programming for Problem Solving Lab	All Branches	0	0	2	1	25	25	50	--
6.	IDT151	Creativity, Innovation & Design Thinking	All Branches	1	0	0	1	20	30	50	1.5
7.	INT151	Workshop/Manufacturing Practices Lab	All Branches	1	0	0	1	20	30	50	1.5
8.	INP151	Workshop/Manufacturing Practices Lab	All Branches	0	0	2	1	25	25	50	--
9.	HUT151	English	All Branches	2	0	0	2	40	60	100	03
10.	HUP151	English Lab	All Branches	0	0	2	1	25	25	50	--
			Total	14	2/1	9	**20.5/19.5**			**700**	

Scheme of Teaching & Examination of Bachelor of Engineering
III Semester B.E. (Electronics Engineering)

Sr. No.	Course Code	Course Title	Hours per week L	T	P	Credits	Maximum Marks: Continuous Evaluation	End Sem Exam	Total	ESE Duration (Hrs)
1	MAT254	Complex Variables and Partial Differential Equation	2	0	0	2	40	60	100	3hrs
2	EET261	Network Theory	3	0	0	3	40	60	100	3Hrs
3	ENT251	Electronic Devices and Circuits	3	1	0	4	40	60	100	3Hrs
4	ENP251	Electronic Devices and Circuits Lab	0	0	2	1	25	25	50	
5	ENT252	Digital Circuit Design	3	0	0	3	40	60	100	3Hrs
6	ENP252	Digital Circuit Design Lab	0	0	2	1	25	25	50	
7	ENT253	Signals and Systems	3	1	0	4	40	60	100	3Hrs
8	CST261	Data structures and Algorithms	2	0	0	2	40	60	100	3Hrs
9	CSP261	Data structures and Algorithms lab	0	0	2	1	25	25	50	
10	CHT251	Environmental Studies	2	0	0	0				
	TOTAL academic engagement		**18**	**2**	**6**	**21**				

Scheme of Teaching & Examination of Bachelor of Engineering
IV Semester B.E. (Electronics Engineering)

Sr. No.	Course Code	Course Title	Hours per week L	T	P	Credits	Maximum Marks: Continuous Evaluation	End Sem Exam	Total	ESE Duration (Hrs)
1	ENT254	Digital Signal Processing	3	0	0	3	40	60	100	3Hrs
2	ENP254	Digital Signal Processing Lab	0	0	2	1	25	25	50	
3	ENT255	Analog Circuits	3	1	0	4	40	60	100	3Hrs
4	ENP255	Analog Circuits Lab	0	0	2	1	25	25	50	
5	ENT256	Microprocessor and Microcontroller	3	0	0	3	40	60	100	3Hrs
6	ENP 256	Microprocessor and Microcontroller Lab	0	0	2	1	25	25	50	
7	ENT257	Electromagnetic Fields	3	0	0	3	40	60	100	3Hrs
8		Open Elective 1	3	0	0	3	40	60	100	3Hrs
9	IDT254	Biological Science	3	0	0	3	40	60	100	3Hrs
	TOTAL academic engagement		**18**	**1**	**6**	**22**				

Scheme of Teaching & Examination of Bachelor of Engineering
V Semester B.E. (Electronics Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	EET361	Control Systems	3	0	0	3	40	60	100	3Hrs
2	ENT351	Electromagnetic Waves	3	0	0	3	40	60	100	3Hrs
3	ENT352	CMOS Digital Circuit Design	3	1	0	4	40	60	100	3Hrs
4	ENP352	CMOS Digital Circuit Design lab	0	0	2	1	25	25	50	
5	ENT353	Electronic Instrumentation	3	0	0	3	40	60	100	3Hrs
6	ENP354	Instrumentation and control Lab	0	0	2	1	25	25	50	
7	ENT355	Program Elective – 1	3	0	0	3	40	60	100	3Hrs
8	ENP355	Program Elective – 1 lab	0	0	2	1	25	25	50	
9		Open Elective 2	3	0	0	3	40	60	100	3Hrs
10	HUT351	Professional Skill Development	2	0	0	0				
		TOTAL Academic Engagement	**20**	**1**	**6**	**22**				

Program Elective – 1 (V Semester)	
ENT 355-1	Embedded System Design and RTOS
ENT 355-2	Mechatronics
ENT 355-3	Digital Image Processing
ENT 355-4	Object Oriented Programming

Scheme of Teaching & Examination of Bachelor of Engineering
VI Semester B.E. (Electronics Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	MBT351	Business management and entrepreneurship	3	0	0	3	40	60	100	3Hrs
2.	ENT357	Analog and Digital Communication	3	1	0	4	40	60	100	3Hrs
3.	ENP357	Analog and Digital Communication Lab	0	0	2	1	25	25	50	
4.	ENT358	Probability Theory and Stochastic processes	3	0	0	3	40	60	100	3Hrs
5.	ENP359	Electronic Design workshop	0	0	2	1	25	25	50	
6.	ENT360	Computer Architecture and Organization	3	0	0	3	40	60	100	3Hrs
7.	ENP360	Computer Architecture and Organization lab	0	0	2	1	25	25	50	
8.	ENT361	Program Elective – 2	3	0	0	3	40	60	100	3Hrs
9.	ENP361	Program Elective – 2 lab	0	0	2	1	25	25	50	
10.		Open Elective 3	3	0	0	3	40	60	100	3Hrs
11.	ENP363	Comprehensive Viva	0	0	2	1	25	25	50	
		TOTAL Academic Engagement	**18**	**1**	**10**	**24**				

Program Elective – 2 (VI Semester)	
ENT 361-1	Designing the IoT
ENT 361-2	Microwave Theory & Techniques
ENT 361-3	Machine Learning
ENT 361-4	Database Management System

Scheme of Teaching & Examination of Bachelor of Engineering
VII Semester B.E. (Electronics Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	ENT451	Computer Networks	3	0	0	3	40	60	100	3Hrs
2	ENP451	Computer Networks Lab	0	0	2	1	25	25	50	
3	ENT452	Program Elective -3	3	0	0	3	40	60	100	3Hrs
4	ENT453	Program Elective -4	3	0	0	3	40	60	100	3Hrs
5		Open Elective 4	3	0	0	3	40	60	100	3Hrs
6	ENP455	Project Stage-I	0	0	10	5	100		100	
7	ENP456	Industry internship evaluation(6-8 weeks)	0	0	2	0	50		50	
		TOTAL academic engagement	**12**	**0**	**14**	**18**				

Program Elective -3 (VII Semester)		Program Elective -4 (VII Semester)	
ENT 452-1	Digital System Design	ENT 453-1	Testing and Verification of digital systems
ENT 452-2	Wireless communication	ENT 453-2	Fiber Optics Communication
ENT 452-3	Analog IC Design	ENT 453-3	Micro-Electro Mechanical System

Scheme of Teaching & Examination of Bachelor of Engineering
VIII Semester B.E. (Electronics Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	ENT457	Program Elective - 5	3	0	0	3	40	60	100	3Hrs
2	ENT458	Program Elective - 6	3	0	0	3	40	60	100	3Hrs
3	ENP459	Project Stage-II/ Internship / Incubation(Six months)	0	0	18	9	50	50	100	
TOTAL Academic Engagement			**6**	**0**	**18**	**15**				

Program Elective -5 (VIII Semester)		Program Elective -6 (VIII Semester)	
ENT 457-1	CMOS Subsystem Design	ENT 458-1	Nano Electronics
ENT 457-2	Information Theory and Coding	ENT 458-2	SoC Design
ENT 457-3	Biomedical Electronics	ENT 458-3	Power Electronics

Open Elective Pool-1(V/VII semester)		Open Elective Pool-2(IV/VI semester)	
ENT298-1/ENT398-1	Smart Agriculture	ENT299-1/ENT399-1	Industrial automation
ENT298-2/ENT398-2	Arduino Playground	ENT 299-2/ENT399-2	Micro Nano system
ENT298-3/ENT389-3	Consumer Electronics	ENT299-3/ENT399-3	Designing with Raspberry pi

Scheme of Teaching & Examination of Honors Specialization in Electronics Engineering

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	ENTH41	Digital System Design	4	0	0	4	40	60	100	3Hrs
2.	ENTH51	VLSI Technology	4	0	0	4	40	60	100	3Hrs
3.	ENTH61	VLSI Signal Processing	4	0	0	4	40	60	100	3Hrs
4.	ENTH71	Low Power VLSI	4	0	0	4	40	60	100	3Hrs
5.	ENTH81	VLSI Design Automation	4	0	0	4	40	60	100	3Hrs
TOTAL academic engagement							**20**			

Note: Credit transfer against above courses may be allowed if an appropriate MOOC course is completed by student after prior permission from HOD

Scheme of Teaching & Examination of Minor Specialization in Electronics Engineering

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	ENTM41	Fundamentals of Electronic Devices and Circuits	4	0	0	4	40	60	100	3Hrs
2.	ENTM51	Digital Circuits	4	0	0	4	40	60	100	3Hrs
3.	ENTM61	Microprocessors and Micro-controller based Design	4	0	0	4	40	60	100	3Hrs
4.	ENTM71	Electronic Instrumentation	4	0	0	4	40	60	100	3Hrs
5.	ENPM81	Mini Project	0	0	4	4	50	50	100	3Hrs
TOTAL academic engagement						**20**				

Note: If any of the above course is accessible to a student in his/her parent branch or Open electives then Credit transfer against above courses may be allowed if an appropriate MOOC course is completed by student after prior permission from HOD.

Syllabus for Semester I / II
(Civil Engineering, Industrial Engineering)

Course Code: PHT151 **Course : PHYSICS : Mechanics**
L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits: 4**

Course Objectives:

1. To develop working knowledge of methods to treat particle and rigid body motions;
2. To introduce kinematics and dynamics of general rigid body motions.

Course Outcomes:

After successful completion of the course students will

1. be able to understand and work with free, damped and forced oscillations;
2. be able to recognize and work problems with conservative as well as non-conservative forces ;
3. be able to use vector dierential operations in solving mechanics problems;
4. understand how to describe and solve simple general rigid body motions.

Module 1: Forces, Newton's Laws (8L)

Coordinate frames, change of frames as linear transformation, rotation matrix, Scalars and vectors - Denition based on their transformation under change of frames; Examples and problems; Newton's Laws of Motion, First law (law of inertia), inertial frame; Second law, concept of force; Third law; Forces in Nature, derived forces; friction, pressure in a fluid; Examples and problems including friction and constraints.

Module 2: One, and Two-dimensional Motion (7L)

One-dimensional harmonic oscillator, damped oscillator, over, critical and under damping; Forced oscillator, undamped and damped cases; Examples, resonance and Q factor; Projectile motion with drag; Two-dimensional oscillator; Charged particle in constant magnetic field.

Module 3: Conservative Forces (5L)

Work and kinetic energy: work-energy theorem, scalar and vector fields, Work done by a force field; Conservative and non-conservative forces, Potential energy function for conservative forces; Gradient of potential energy, F = - V; Curl of a vector field, test of conservation character of a force; Potential near equilibrium point.

Module 4: Angular Momentum, System of Particles (6L)

Angular momentum of a particle, torque of force; Radial-polar coordinates, Planetary orbits and Kepler's laws; elliptical, parabolic and hyperbolic trajectories; **' L'** of a system of particles, torque of external forces,

$$\frac{d\bar{L}}{dt} = \bar{N}_{ext}$$

Module 5: Rigid Body Dynamics-1 (5L)

Denition of a rigid body, rotation in a plane, angular momentum about a point of rigid body in planar motion about a fixed axis, Kinematics, concept of moment of inertia; The physical pendulum.

Module 6: Rigid Body Dynamics-2 (7L)

General rotation of a rigid body, Euler angles, angular velocity; Kinetic energy, moment of inertia tensor, examples, parallel axis theorem, angular momentum of a rigid body; Euler's equations of rigid body dynamics (statement and meaning without derivation), simple examples: rotating rod, torque-free precession.

Text Book:

1. Introduction to Mechanics (Second Edition), M. K. Verma, Universities Press 2016.

References:

1. An Introduction to Mechanics, Daniel Kleppner and Robert Kolenko, Cambridge University Press 2010.
2. Online course: Engineering Mechanics (Modules 1, 2,5, 6, 7, 8) by M K Harbola on NPTEL
3. Engineering Mechanics (Second Edition), M K Harbola, Cengage publications, New Delhi, 2013.

Syllabus for Semester BE I / II

Bachelor of Mechanical Engineering, Electrical Engineering

Course Code: PHT152 **Course: Oscillations, Waves, Optics**

L:3 Hrs.,T:1Hrs.,P:0Hrs.,Per week **Total Credits:4**

Course Objectives:

1. To train the student to work with oscillatory phenomena in electrical, mechanical and optical systems;
2. To introduce fundamental concepts and laws as relevant to electromagnetic waves and matter waves.

Course Outcomes:

After successful completion of the course students will understand and be able to work with

1. Free, damped and forced oscillations;
2. Fundamental properties of mechanical waves and their propagation across material boundaries;
3. Basics of electromagnetic waves and optical media, phenomena of interference, diffraction of optical waves
4. Elementary understanding of quantum behavior of electrons in solids.

Module 1: Oscillations (8L)

Quick review of simple harmonic motion, mechanical and electrical oscillators, vector and complex number (phasor) representation, superposition of many SHMs of equal amplitude and equal successive phase difference; Damped oscillations, under, critical and over-damping with stress on mechanical oscillators, problems; Forced oscillations with focus on electrical/mechanical oscillations, impedance of a electrical/mechanical circuit, forcing frequency dependence of velocity, displacement in a forced oscillator, two components of displacement, energy and power supplied by driving force, Q factor.

Module 2: Waves - 1 (5L)

Correlated harmonic oscillations in space and time, statement and meaning of the wave equation, general solution, concept of polarization of waves- transverse and longitudinal waves; Transverse wave on a string, characteristic impedance, reflection and transmission at a string-string boundary, impedance matching, insertion of quarter-wave element.

Module 3: Waves - 2 (5L)

Group of waves, group velocity, meaning of dispersion, causes of dispersion; Standing waves, normal modes of vibrating string, energy in modes, standing wave ratio; Longitudinal waves: sound waves in gases, statement and meaning of expressions for energy distribution and intensity.

Module 4: Wave Optics - 1 (6L)

Light as a transverse polarized electromagnetic wave in vacuum and in homogeneous isotropic dielectric, impedance $|\mathbf{E}|/|\mathbf{H}_{perp,E}|$, Poynting vector, energy; Reflection and refraction of em wave at dielectric-dielectric boundary, parallel and perpendicular polarizations, boundary conditions on E and H components, Fresnel

equations, Brewster's angle.

Module 5: Wave Optics - 2 (6L)

Huygens' principle, superposition, interference by division of amplitude and wavefront, Young's double-slit, Newton's rings, Michelson interferometer; Single-slit Fraunhofer diffraction, Rayleigh criterion for resolution, grating and its resolving power.

Module 6: Matter Waves (8L)

Plank's energy packets, Wave-particle duality of de Broglie, Heisenberg uncertainty relations; Wave function for matter waves and its interpretation, position and momentum operators, Hamiltonian operator, Schrodinger's equation; One-dimensional single particle systems: Particle in a infinite square well potential (rigid box), Finite square well potential; Quantum tunneling.

Text Book(s):

1. The Physics of Vibrations and Waves (Sixth Edition), H J Pain John-Wiley 2005.
2. Optics, Ajoy Ghatak, Tata McGraw Hill Education 2005

References:

1. Online course: Oscillations and Waves by S Bharadwaj on NPTEL
2. Engineering Physics (Second Edition), Sanjay Jain and Girish Sahasrabudhe, Universities Press 2016.

Syllabus for Semester I / II

(Electronics Engineering, Electronics Design Technology, Electronics and Communication Engineering, Information Technology, Computer Science Engineering)

Course Code : PHT153 **Course: Semiconductor Physics**

L: 3 Hr., T: 1 Hrs., P : 0 Hrs., Per week **Total Credits : 4**

Course Objectives:

1. To introduce ideas of quantum mechanics necessary to begin understanding semiconductor devices;
2. To familiarize prospective engineers with fundamental concepts of semiconductors and their interaction with light and resulting devices

Course Outcomes:

After successful completion of the course students will

1. have an elementary understanding of quantum behavior of electrons in solids;
2. have a grasp of band structure and its consequences for semiconductors;
3. should be able to use band structure to explain effects of doping, properties of junctions between semiconductors and metals;
4. have an elementary understanding of working of optoelectronics devices

Module 1: Quantum Mechanics Introduction (6L)

Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Energies and wave functions of a single electron in one-dimensional infinite potentials: formulae, function graphs, number of bound states, tunneling

Module 2: Electronic Materials (8L)

Free electron theory, Extension of idea of energy level splitting in molecules to bonding in solids, Energy bands in solids, Kronig-Penny model (to better demonstrate origin of band gaps), Band gap based classification of electronic materials: metals, semiconductors, and insulators, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics: Occupation probability of states, Fermi level, Effective mass.

Module 3: Intrinsic and Extrinsic Semiconductors (10L)

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift, Carrier generation and recombination, Continuity equation, Ambipolar transport.

Module 4: Junction Physics (8L)

p-n junction, Zero applied bias, forward bias, reverse bias, Metal-semiconductor junction, Shottky barrier, Ideal junction properties, Ohmic contacts, ideal non-rectifying barrier, tunneling barrier, Heterojunctions,

Module 5: Light - Semiconductors Interaction (6L)

Optical transition in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states in bulk semiconductors, density of states for photons, semiconductor materials for optoelectronic devices, electron hole pair generations, Photovoltaic effect, Solar cells, Light emitting diodes, population inversion, Optical loss and gain, Semiconductor Laser.

Module 6: Engineered Semiconductor Materials (6L)

Low-dimensional systems such as quantum wells, wires, and quantum dots: design, fabrication, and characterization techniques. Energies and wave functions in three dimensions with one, two, or all three dimensions of nano-sizes, Density of states for 2D, 1D and 0D electron gases, Heterojunctions and associated band-diagrams.

Text Book:

1. Semiconductor Physics and Devices (Fourth Edition), Donald A Neamen, McGraw-Hill 2012.

References:

1. Online course: Semiconductor Optoelectronics by M R Shenoy on NPTEL
2. Online course: Optoelectronic Materials and Devices by Monica Katiyar and Deepak Gupta on NPTEL
3. Principles of Electronic Materials and Devices (Third Edition), S. O. Kasap, McGraw-Hill 2006.
4. Engineering Physics (Second Edition), Sanjay Jain and Girish Sahasrabudhe, Universities Press 2016.

Syllabus of Physics Lab for Semester II, Bachelor of Industrial, Civil Engineering

Course Code : PHP151 **Course : Mechanics Lab**

L:0 Hr., T:0Hrs., P:3 Hrs., Per week **Total Credits : 1.5**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experiments based on the following list:

1. Error analysis and graph plotting
2. g by free fall
3. To determine acceleration due to gravity by compound pendulum
4. To determine the moment of inertia of a body using torsion pendulum
5. Young's modulus by bending of beam
6. Young's modulus by vibrational method
7. To study damping of a bar pendulum
8. Fixed pulley, loose pulley, and block and tackle as simple machine
9. Static friction, sliding friction, and rolling friction
10. Force oscillation and resonance
11. To study the oscillation of a mass in combinations of two springs and hence determination of force constant
12. Measurement of linear expansion of solid as a function of temperature
13. Determination of thermal conductivity of building materials using single plate model or heat flux plate principle
14. Thermal diffusivity Used for measuring the thermal diffusivity and thermal conductivity of brass.
15. Thermal conductivity of a bad conductor by Lee's disc method.
16. Data analysis using Mathematica.

Suggested References:

1. Physics Lab Manual written by the Teaching Faculty of Physics Department, RCOEM.

A minimum of 8 experiments to be performed from the following list of experiments

Syllabus of Physics Lab for Semester I/II,

(Semester-I: Electrical Engineering, Semester-II: Mechanical Engineering)

Course Code : PHP152 **Course : Oscillations, Waves , Optics lab**

L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program:

1. Error analysis and graph plotting
2. Wave length, frequency and phase velocity of travelling wave.
3. Wavelength of source of light using Newton's rings
4. To study the oscillation in bifilar suspension arrangement
5. Determination of velocity of sound in liquid–standing ultrasonic waves as optical grating
6. Kundt's tube – Determination of the wavelength of sound with the cork powder method
7. Determination of velocity of sound in solid
8. Beating of ultrasonic waves
9. Investigation of Doppler effect with ultrasonic waves
10. Refractive Index of prism
11. Frequency, amplitude and phase determination using C.R.O.
12. Study of surface flatness using interference phenomena
13. To determine the resolving power of grating
14. Study of Polarizers and Analyzers
15. Study of total internal reflection using Laser source
16. Data analysis using Mathematica

Suggested References:

1. Physics Lab Manual written by the Teaching Faculty of Physics Department, RCOEM.

A minimum of 8 experiments are to be performed from the above list of experiments.

Syllabus for Semester I/II, B.E. (2018-19)

(Semester I: Electronics, Electronics Design Technology, Electronics & Communication Engineering)

(Semester II: Computer Science Engineering and Information Technology)

Course Code : PHP153 **Course : Semiconductor Physics Lab**

L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program

1. Error analysis and graph plotting
2. Energy gap of semiconductor/thermister
3. Study of Hall Effect
4. Parameter extraction from I-V characteristics of a PN junction diode
5. Parameter extraction from I-V characteristics of a zener diode
6. Study of diode rectification
7. Parameter extraction from I-V characteristics of a transistor in common-emitterconfiguration.
8. Determination of Planck's constant
9. Determination of time constant of RC circuit
10. V-I Characteristics of Light Emitting Diodes
11. Study of a photodiode
12. Solar Cell (Photovoltaic cell)
13. Resistivity measurement by Four Probe method
14. Van der Pau and conventional techniques for resistivity measurement (LCR meter)
15. Study of R-C filters using C.R.O.
16. Data analysis using Mathematica.

A minimum of 8 experiments to be performed from the following list of experiments

Syllabus for B. E. Semester II

Course Code: MAT151 **Course: Mathematics-I: Calculus**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 04**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics & applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions and the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
2. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. To deal with functions of several variables that are essential in most branches of engineering.

Syllabus

Module 1 Calculus: (6 hours)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3:Sequences and series: (10 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4:Multivariable Calculus (Differentiation) (10 hours)

Limit, continuity and partial derivatives, Jacobians, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl & divergence.

Module 5: Multivariable Calculus (Integration) (10 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double

integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes.

Text Books/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune - 411030 (India).

Syllabus for B.E. Semester I

Course No. MAT152 — **Course : Mathematics-II: Differential Equations, Linear Algebra, Statistics & Probability**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week — **Total Credits : 03**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equation, statistics, probability and Matrices. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Syllabus

Module 1:First order ordinary differential equations(7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 2:Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

Module 3: Basic Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation.

Module 4: Basic Probability: (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Text Books/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory & Problems of probability and statistics : 2nd ed :J. R. Spiegal, Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune - 411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus of Mathematics Computational Lab for Semester I/II, B.E. (2018-19)

Course Code : MAP151 **Course : Computational Mathematics Lab**

L:0 Hr., T:0Hrs., P:2 Hrs., Per week **Total Credits : 1**

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Suggested References:

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

A minimum of 8 experiments to be performed based on the above list.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EET151 **Course : Basic Electrical Engineering**

Course Outcomes:

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

CO1: To understand and analyze basic electric and magnetic circuits.

CO2: To study the working principles of electrical machines and power converters.

CO3: To study the working principles of power converters.

CO4: To introduce the components of power systems and low-voltage electrical installations.

Module 1: Introduction to Power system (2 hours)– CO4:

Introduction to Power Generation (Thermal, Hydro, Nuclear, Wind, and Solar) with block schematic presentation only. Single line diagram for Generation, Transmission & Distribution through different voltage levels.

Module 2 : DC Circuits & Magnetic Circuits(8 hours) - CO1:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation, Time-domain analysis of first order RL and RC circuits, Magnetic materials, BH characteristics, Basics of Magnetic circuits.

Module 3: Single Phase AC Circuits (6 hours) - CO1:

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), resonance.

Module 4: Three Phase AC Circuits (4 hours) - CO1:

Three phase Ac generation, Three phase balanced circuits, voltage, and current relations in star and delta connections. Power factor improvement.

Module 5: Transformers (6 hours) - CO2:

Ideal and practical transformer, Equivalent circuit, losses in transformers, regulation, and efficiency. Auto transformer and three-phase transformer connections.

Module 6: Electrical Machines (8 hours) - CO2:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components, efficiency, starting of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic, and speed control of separately excited dc motor.

Module 7: Power Converters (4 hours) - CO3:

Block schematic introduction to power converters and its practical applications (DC-DC, DC-AC, AC-DC, AC-AC), Types of Batteries, Important Characteristics for Batteries and battery backup.

Module 8: Electrical Installations (4 hours) - CO4:

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption, energy tariff.

Text Books / References:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
6. Electrical Technology: B. L. Thereja, S. Chand Publications.
7. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EEP151 **Course: Basic Electrical Engineering Lab.**

Laboratory Outcomes: The students are expected to

CO1: Get an exposure to common electrical components and their ratings.

CO2: Make electrical connections by wires of appropriate ratings.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Understand the basic characteristics of transformers and electrical machines.

CO5: Get an exposure to the working of power electronic converters.

List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions. Introduction & use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
   Observation of phase differences between current and voltage.
3. Transformers : Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-toneutral voltage, line and phase currents). Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of dc shunt motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
8. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Syllabus of Department of Mechanical Engineering

Course Code : MET151 **Course: Engineering Graphics and Design**

L:1 Hr., T:0Hrs., P:0 Hrs., Per week **Total Credits : 01**

Course Outcomes

The expected learning outcome is that, the students shall be able to

1. Draw and interpret technical drawing
2. Convert 2-D to 3-D drawing and vice versa.
3. Represent the various positions of planes and solids in different orientations.
4 Develop the solid surface for sheet metal working.

UNIT 1 : Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of drawing instruments, Lettering and dimensioning.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions : Projections of Points and lines (line inclined to both planes) Projections of planes (inclined to both the planes), Introduction to Auxiliary Planes;

UNIT 3 : Projections of Solids

Inclined to both the Planes - Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include : windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid Cone-Auxiliary Views; Development of surface 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)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; Conversion of Orthographic views to Isometric Views / Projection.

Suggested Text / Reference Books :

i) Bhatt N. D. Panchal V.M. & Ingle P.R., (2014) Engineering Drawing, Charotar Publishing House.

ii) Jolhe D. A. (2016) Engineering Drawing with an Introduction to Auto CAD", Tata McGraw- Hill Publishing Co. Ltd., New Delhi.

iii) Narayan K. L. & P. Kannalah (2008), Text book on Engineering Drawing, Scitech Publishers.

iv) Shah, M. B. & Rana B. C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

v) Agrawal B & Agrawal C. M. (2012), Engineering Graphic, TMH Publication.

vi) Corresponding set of CAD Software Theory and User Manuals.

Syllabus of Department of Mechanical Engineering

Course Code : MEP151 **Course: Engineering Graphics & Design Lab**

L:0 Hr., T:0Hrs., P:4 Hrs., Per week **Total Credits : 02**

Course Outcomes

Students are prepared for actual work situations through practical training in a new state of the art computer designed CAD laboratory using engineering software. The student will learn to :

1. Draw and interpret technical drawing
2. Plan the sheet layout for the given drawing
3. Convert 2-D to 3-D drawing and vice versa
4. Represent the various positions of planes and solids in different orientations.
5. Develop the solid surface for sheet metal working
6. Use & demonstrate drafting package.

UNIT 1 : Introduction to Engineering Drawing

Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloids, Hypocycloid and involutes; Introduction to Scales.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions - Projections of Points and lines inclined to both planes; Projections of planes - Auxiliary Planes.

UNIT 3 : Projections of Solids

Inclined to both the Planes Auxiliary Views; Draw simple annotation, dimensioning and scale, Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism Cylinder, Pyramid, Cone - Auxilary 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)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; conversion of Orthographic views to Isometric views / Projection

UNIT 6 : Overview of Computer Graphics

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 Systems),

Dialog boxes and windows, Shortcut menus (Button Bars), The command Line (wherever 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);

UNIT 7 : Customization & CAD Drawing

Setting up drawing page and the printer, including scale settings, Setting up of units and Drawing limits; ISO and ANSI standards for coordinate dimensioning; Orthographic constraints, map to objects, manually and automatically, Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT 8 : Annotations Layering & Other Functions

Applying dimensions to objects, applying annotations to drawings; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

UNIT 9 : Demonstration of a simple team design project that illustrates

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 toplogies for engineering, Introduction to Building Information Modeling (BIM)

List of sheets

1. Curves (ellipse, Parabola, hyperbola, Cycloid, involute)
2. Line, Planes, Solids
3. Application of Section and development of solids
4. Orthgraphic Projection
5. Isometric
6. Auto CAD practic sheet 1
7. Auto CAD practice sheet 2
8. Blueprint sheet

Suggested Text/ Reference Books :

i) Bhatt N.D. Panchal V.M. & Ingle P.R., (2014), Engineering drawing, Charotar Publiishing house

ii) Jolhe D.A., (2016) Engineering drawing with an Introduction to Auto CAD", Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

iii) Shah M.B. & Rana B.C. (2008), Engineering drawing and Computer Graphic, Pearson Education.

iv) Agarwal B & Agarwal C.M. (2012), Engineering Graphics, TMH PUBLICATION

v) Narayana, K.L & P Kannaiah (2008), Text Book on Engineering Drawing, Scitech Publishers.

vi) (Concesponding set of) CAD Software Theory and USER Manuals.

Syllabus for B.E. Semester I Department of Humanities

Course Code : HUT152 **Course : Constitution of India**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 0**

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Text Book

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, Lexis Nexis

Syllabus for B.E. Semester I Department of Humanities

Course Code : PEP151 **Course : Yoga / Sports**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits : 0**

Course outcome

On successful completion of the course, students will be able to:

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes:

It has long been prov

en that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline:

Sports :

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

Yoga : Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.

Physical Efficiency Tests : This includes 6 health related physical fitness tests.

Components	Name of Tests
Speed	50 mts Dash
Agility	Shuttle run
Cardiovascular Endurance	8 mins Run/Walk
Test Flexibility	Sit and Reach Test
Abdominal Strength (M) / shoulder strength (F)	Bent Knee Sit-ups (M)/ Modified Pull-ups (F)
Yogic exercises	Suryanamaskars

Syllabus for B.E. Semester I / II

Course Code : CHT151 **Course : Chemistry**

L: 3 Hrs, T: 1 Hr, P : 0 Hr., Per week **Total Credits : 4**

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10 + 2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nano meter levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

(i) Chemistry-I (Concepts in Chemistry for Engineering)

(i) Atomic and molecular structure (12 lectures)

Schroedinger equation. Particle in box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry & chirality, enantiomers, diastereomers, optical activity, absolute configurations & conformational analysis. Isomerism in transitional metal compounds.

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

(i) University chemistry, by B. H. Mahan
(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
(iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(v) Physical Chemistry, by P. W. Atkins
(vi) Organic Chemistry: Structure & Function by K. P. C. Volhardt & N. E. Schore, 5th Edition http://bcs.whfreeman.com/ vollhardtschore5e/default.asp
(vii) Selected topics in Inorganic Chemistry by Malik, Madan & Tuli.

Syllabus for B.E. Semester I / II

Course Code : CHP151 **Course : Chemistry Lab**

L: 0 Hrs., T: 0 Hrs., P: 3 Hrs., Per week **Total Credits : 1.5**

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials and impurities in water etc.
- Synthesize a polymer or drug molecule or nano-material.

List of Experiments for Chemistry Lab

1. Determination of Surface tension and Viscosity of a given liquid.
2. Determination of total hardness and alkalinity of a given water sample.
3. Synthesis of a polymer.
4. Determination of Cu and Zn in a brass sample.
5. Determination of partition coefficient of a substance between two immiscible liquids.
6. Study of chemical oscillations or iodine clock reaction.
7. Estimation of acid value and saponification value of oil.
8. Determination of cell constant and conductometric titration of strong acid vs. strong base.
9. Colligative properties using melting point.
10. Determination of rate constant of a reaction.
11. Ion Exchange column for removal of hardness.
12. Synthesis of nanoparticles.
13. Adsorption of acetic acid by charcoal.
14. Demonstration of UV-Visible spectrophotometer and FTIR

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CST151 **Course : Programming for Problem Solving**

L: 4 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 4**

Course Outcomes :

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. To apply programming to solve matrix addition, multiplication problems and searching & sorting problems.

UNIT-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

UNIT-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

UNIT-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings.

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

UNIT-VI: File handling

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush().

Text Books:

1. Programming in ANSI C : E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books:

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CSP151 **Course : Programming for Problem Solving Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits : 1**

Course Outcomes :

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

CREATIVITY INNOVATION AND DESIGN THINKING
COURSE SYLLABUS

Course Code : IDT151 **Credits:1**

L:1Hrs., T:0Hrs., P:0Hrs., Per week

Course Outcomes

C1: Be familiar with processes and methods of creative problem solving

C2: Enhance their creative and innovative thinking skills

C3: Practice thinking creatively and innovative design and development

Detailed Topics

UNIT I. Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

UNIT 2. Pattern Breaking: Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking , Mapping thoughts, Other (new approaches)

UNIT 3. Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

UNIT4. Systematic Inventive Thinking: Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats , Ethical considerations

UNIT 5. Design for Innovation: Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

UNIT 6.Intellectual Property: Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, Trade Secret, Unfair Competition.

Reference Books and Text Books :

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

Syllabus Department of Industrial Engineering

Course Code : INT151 **Course : Workshop / Manufacturing Practices (Theory)**

L:1Hrs., T:0Hrs., P:0Hrs., Per week **Total Credits:1**

Course Outcomes

1. Identify the different manufacturing process commonly employed in Industry along with prevailing safety practices.
2. Identify the various tools and equipments to carry out different manufacturing processes accompanied by the inspection of the work part.

Syllabus

Unit-1 Fundamentals of metal cutting, single point cutting tool, fundamental mechanics of metal cutting, fitting operations, and associated measuring and marking tools

Unit-2 Introduction to pattern making for metal casting, different types of carpentry tools, measuring tools and marking tools, holding devices, different types of carpentry joints.

Unit-3 Smithy and Forging, Forging tools like chisels, hammers, types of furnaces, types of coal, Forming operations, Hot working and Cold working of metals.

Unit-4 Metal joining Process, mechanics of welding, types of welding, soldering and brazing, types of joints

Unit-5 Introduction to foundries, Metal Casting, types of sand, Introduction to Molding tools & casting process.

Unit-6 Introduction to Plastic Injection Molding

Suggested Text Book

1. "Elements of Workshop Technology" Hajra S.K, Choudhury A. K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd. Mumbai.

Reference Books

1. Kalpakjian S. and Schmid S. “Manufacturing Engineering and Technology”4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, “Process and Materials of Manufacture”4th Edition, Prentice Hall India 1998.

Syllabus Department of Industrial Engineering

Course Code : INP151 **Course : Workshop/Manufacturing Practices Lab (Practical)**

L:0Hrs.,T:0Hrs.,P:2Hrs.,Per week **Total Credits:1**

Laboratory Outcomes

On the completion of the course the students shall be able to;

1. Recognize the different manufacturing process commonly employed in the Industry
2. Make the components using required manufacturing process, inspection methods while practicing the requisite safety precautions

Contents

1. Fitting Practice
2. Welding and Soldering Practice
3. Pattern Making Practice
4. Metal Casting Practice
5. Smithy and Forging Practice
6. Machining Practice
7. Plastic Molding Process
8. Glass Cutting Process

Suggested Text Book

1. "Elements of Workshop Technology'" Hajra S.K, Choudhury A.K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd Mumbai.

Reference Books

1. Kalpak Jain S. and Schmid S. "Manufacturing Engineering and Technology"4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, "Process and Materials of Manufacture", Prentice hall India 1998.

Syllabus for B.E. Semester I / II Dept of Humanities

Humanities and Social Sciences

Course Code: HUT151 **Course : English**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 2**

Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

SYLLABUS

1. Vocabulary Building

1.1. The concept of Word Formation
1.2. Root words from foreign languages and their use in English
1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives
1.4. Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Redundancies

3.6 Cliches

4. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence

5. Writing Practices

5.1 Comprehension
5.2 Precis Writing
5.3 Essay Writing
5.4 Letter Writing
5.5 Email Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations : Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Text Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for B.E. Semester I

Course Code: HUP151 **Humanities and Social Sciences including Management courses** **Course : English Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 1**

Course objective :

1. To enhance competency of communication in English among learners.

Course outcomes:

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

List of Practical (2 hours each for each batch) based on unit 6 (oral communication).

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation , Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

Syllabus of Semester III, Bachelor of Engineering

Course Code: MAT254 **Course : Complex Variables and Partial Diff Equation**

L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 02**

Course Outcomes

On successful completion of the course, The students will learn:

1. The effective mathematical tools for the solutions of partial differential equations that model physical processes.
2. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Module 1:

Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 2:

Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

Module 3:

Partial Differential equations: **(8 lectures)**

Partial differential equation of first order first degree i.e. Lagrange's form. Linear homogeneous PDE of n^{th} order with constant coefficient, method of separation of variables, Applications of partial differential equations.

Text Books

1. Higher Engineering Mathematics: *B. S. Grewal, 43rd ed: Khanna Publishers, Delhi (India).*
2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

Reference Books:

1. Advanced Engineering Mathematics, 8th ed: *Erwin Kreyszig Neekunj print process, Delhi.*
2. Schaum's Outline of Complex Variables, 2nd ed: Murray R Spiegel, Seymour Lipschutz, John J. Schiller, Dennis Spellman, *TMH, New Delhi.*
3. Advanced Engineering Mathematics, 2nd ed :*Jain, Iyengar , Narosa publication.*
4. Advanced Engineering Mathematics: *H K Dass, S. Chand Publications.*

Syllabus of Semester III, Bachelor of Engineering

Course Code: EET261 **Course : Network Theory**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Outcomes

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

1. Understand basic electrical circuits with modal and mesh analysis.
2. Apply network theorems for the analysis of electrical circuits.
3. Apply Laplace Transform for steady state and transient alalysis.
4. Analyze different network fucntion.
5. Analyze two port network circuit with different interconnections.

Syllabus

Module 1: Node and Mesh Analysis : (7 Hours)

Node and Mesh analysis, matrix approach of network containing voltage, current sources and reactances, source transformation and duality. Mutual coupled circuits, Dot Convention in coupled circuits.

Module 2: Network Theorems : (6 Hours)

Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC circuits.

Module 3: Behaviors of AC circuit and Introduction to Filters (4 Hours)

AC circuit analysis with dependent current and voltage sources. Series and parallel resonant circuits. Introduction to band pass, low pass, high pass and band reject filters.

Module 4: Electrical Circuit Analysis Using Laplace Transforms : (8 Hours)

Review of Laplace Transform, partial fractions, singularity functions, Analysis of electrical circuits using Laplace transform for standard inputs, convolution integral, inverse Laplace transform, evaluation of initial conditions. Transformed network with initial conditions, waveform synthesis, and analysis of RC, RL and RLC networks with and without initial conditions with Laplace transforms.

Module 5 : Transient behavior of Network and Network Functions (5 Hours)

Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem.

Module 6 : Two Port Network : (5 Hours)

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text Books

1. M. E. Van Valkenburg, " Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, " Networks and Systems," New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, " Engineering Circuit Analysis", McGraw Hill Education, 2013.

Reference Books:

1. Sudhakar, A., Shyammohan, S. P., " Circuits and Network", Tata McGraw Hill New Delhi, 1994
2. C. K. Alexander and M. N. O. Sadiku, " Electric Circuits", McGraw Hill Education, 2004.
3. K. V. V. Murthy and M. S. Kamath, " Basic Circuit Analysis", Jaico Publishers, 1999.

Syllabus of Semester III, Bachelor of Engineering

Course Code: ENT251 **Course : Electronic Devices and Circuits**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 4**

Course Outcomes :

Upon the completion of this course students will be able to:

1. Understand the operation and analyze the characteristics of semiconductor diodes, MOSFET and BJT.
2. Examine and design electronic circuits containing non-linear elements such as diodes, MOSFET &BJT using the concepts of biasing, load lines, operating point and incremental analysis.
3. Analyze single and multistage amplifiers at low, mid and high frequencies using low frequency and high frequency models of MOSFET/ BJT.
4. Apply feedback techniques in amplifier and examine its effect on parameters of amplifiers (ex. Gain, bandwidth, i/p and o/p impedance, etc) and the stability of amplifier.
5. Investigate various types of power amplifiers and evaluate their performance parameters.

Module I: (6 Hrs)

Diode Models and Circuits: V-I Characteristics of P-N Junction Diode, load line concepts, DC Analysis and Models of P-N Junction Diode, types of special diodes, Applications of PN junction diode —Rectifier, Clipper, Clamper; Zener Diode circuits —shunt regulator, DC power supply.

Module II : (7Hrs)

Bipolar Junction Transistors: Device structure and Physical Operation, Current Components in BJT, Input-Output and Transfer characteristics in CB, CC and CE configuration, Load line concept, Biasing techniques, Bias Stability, The Ebers-Moll Model and small signal model of BJT, Applications of BJT.

Module III :(8Hrs)

Field-effect Transistors: FET,MOSFET – Classification, Construction, Physical Operation, Volt-Ampere Characteristics, DC operating point, biasing the MOSFET; small signal model of the MOSFET, small signal analysis, Applications of MOSFET: Switch, Amplifier, Digital Logic Inverter.

Module IV: (10Hrs)

Basic BJT & MOSFET Amplifiers: Classification of amplifiers, distortions in amplifiers, basic configurations of MOSFET amplifier, Single-stage and Multi-stage transistor amplifiers, low frequency and high frequency response, effect of emitter (or source) bypass capacitor on the frequency response of amplifier, High frequency model of the MOSFET, Miller's theorem.

Module V: (7Hrs)

Feedback amplifier & Stability: General Feedback amplifier Structure, Properties of Negative Feedback, Basic Feedback Topologies, The Stability of Amplifier, Transfer Function of the feedback Amplifier, Poles and Zeros of Amplifier Transfer Function, Effect of Feedback on the amplifier poles, phase margin, unity gain bandwidth, compensation of the cascaded amplifier.

Module VI: (7 Hrs)

Power Amplifiers: Audio power amplifier, class-A/class-B/class-C; push-pull amplifier, class-AB power

Text Book:

1. Microelectronics Circuits: Theory and Applications :Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Seventh Edition, Oxford University Press, 2017.

Reference Books:

1. Electronic Circuits: Analysis and Design: Donald Neamen, Third Edition, McGraw-Hill Publication, 2006.
2. Solid State Electronic Devices: G. Streetman, and S. K. Banerjee, Seventh edition, Pearson, 2014.
3. Semiconductor Physics and Devices: Basic Principles: Donald Neamen, Fourth edition, McGraw-Hill, 2011.
4. Millman's Integrated Electronics: Jacob Millman, Christos Halkias, Chetan Parikh, Second edition, McGraw Hill Education, 2017.
5. Microelectronics: Behzad Razavi, Second edition, Wiley India Pvt. Ltd., 2018.
6. Electronic Devices and Circuits: David A. Bell, Fifth Edition, Oxford 2008.
7. Microelectronic Circuits Analysis and Design: Muhammad H. Rashid, Second edition, Cengage Learning India, 2012.

Syllabus of Semester IV, Bachelor of Engineering

Course Code: ENT252 **Course : Digital Circuit Design**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

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

1. Understand number systems conversions and apply the principles of Boolean algebra to manipulate, minimize and design logic circuits using logic gates.
2. Demonstrate knowledge of various combinational logic circuits like code converters, multiplexers, adders and use them in the design and analysis of complex hierarchical combinational blocks like multipliers, fast adders etc.
3. Demonstrate knowledge of sequential logic circuits elements like latches, flip-flops and use them in the design and analysis of counters, registers, simple finite state machine and similar circuits.
4. Understand and describe the architecture of logic families, memory elements and combinational digital circuits implementation with programmable logic devices.
5. Design, debug and verify simple digital circuits and systems with the aid of HDL (Verilog) and appropriate EDA tool

Module I: (7 Hrs)

Logic Simplification: Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Logic Gates, combinational Logic Optimization Techniques.

Module II: (6 Hrs)

Combinational logic Design: Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Barrel Shifter, ALU.

Module III: (6 Hrs)

Sequential Logic Design: Latches, Flip flop – S-R, JK, D, T and Master-Slave JK FF, counters, Shift registers, Finite state machines & their implementation.

Module IV: (5 Hrs)

Logic Families and Programmable Devices: Introduction to logic families, comparison and interfacing, Concept of PLDs like ROM, PAL, PLA, CPLDs, FPGA etc. Logic implementation using Programmable devices, Memories & their architecture.

Module V: (5 Hrs)

Overview of Digital Design with HDL: Different methodologies and its implementation process. Introduction to Verilog HDL for Digital Circuit implementation, language constructs.

Module VI: (6 Hrs)

Different Modeling Styles: Structural, sequential behavioral constructs, test bench, synthesis of HDL.

Text Book :

1. Fundamentals of Digital Logic with Verilog : Stephen Brown and ZvonkoVranesic, McGraw Hill, 2nd Edition.

Reference Books :

1) Fundamentals of digital circuits: A. Anand Kumar, Prentice-Hall of India, 4th Edition.
2) Modern digital Electronics: R.P. Jain, Tata McGraw Hill, 4th Edition.
3) Digital Electronic Principles: Malvino , PHI, 3rd Edition.
4) Verilog HDL: A Guide to Digital Design and Synthesis: Samir Palnitkar, Prentice Hall PTR, 2nd Edition.

Syllabus of Semester III, Bachelor of Engineering

Course Code: ENT253 **Course : Signals and Systems**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 4**

Course Outcomes :

Upon the completion of this course, students will demonstrate the ability to:

1. Skillfully use the concepts of mathematics for the analysis of signals and systems in time and frequency domain.
2. Appreciate the importance of Fourier series and Fourier transform techniques
3. Analyze the Continuous Time signals and systems through Laplace Transform
4. Recognize the need for of discretizing a signal and importance of Nyquist Criterion
5. Build necessary foundation for Digital Signal Processing

Syllabus

Module I:(8 Hrs)

Introduction to Signals and Systems: Elementary continuous & discrete time signals, basic operations on signals, classification of signals, introduction to system and system classification

Module II: (8 Hrs)

Time domain analysis of Continuous Time(CT) system: Classical method, convolution integral and their properties, causality, correlation, stability, step response, impulse response of interconnected systems

Module III: (8 Hrs)

Fourier series analysis of CT Periodic signals: Representation, properties, Fourier spectrum, Gibb's phenomenon, introduction to Discrete Time Fourier Series (DTFS)

Module IV:(7 Hrs)

Continuous Time Fourier transform (CTFT): Properties, FT of periodic signals, modulation, system analysis with FT

Module V:(8 Hrs)

Overview of Laplace Transform: Need of Laplace Transform, Unilateral and bilateral LaplaceTransform, properties criterion, concept of Region of Convergence (ROC), inverse of Laplace Transform, the S-plane and BIBO stability criterion and Causality, Transfer function, Solution of differential equations, Analysis of LTI System Using L.T. and Applications, relation between Fourier Transform and Laplace Transform

Module VI: (6 Hrs)

Sampling: Nyquist Criteria of sampling, sampling theorem, aliasing, signal reconstruction, analog to digital conversion, signal transmission though linear system, distortion less transmission through a system, linear phase system, ideal filter, signal and system bandwidth, relationship between bandwidth and rise time

Text Book :

1. Signals and Systems; A.V. Oppenhemn, A.S. Willsky and Hamid Nawab; Pearson publication, 2nd edition 2015

Reference Books :

1) Principles of Linear Systems & Signals: B.P.Lathi, Oxford Press , Second Edition, 2009
2) Signals and Systems; Simon Haykin, Barry van Veen; John Wiley and Sons, 2nd edition, 2003
3) Signals and Systems; A. NagoorKani, Mc Graw Hill Education, 2015

Syllabus of Semester III, Bachelor of Engineering

Course Code: CST261 **Course : Data Structures and Algorithms**

L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 2**

Course Outcomes :

1. For a given algorithm student will be able to analyze he algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will be able to implement it.
3. For a given problem of Stacks, Queues and linked list student will be able to implement it and analyze the same to determine the time and computation complexity.
4. Student will be able to write an algorithm for Insertion Sort, Quick Sort, Merge Sort, & Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will be able to implement Graph search and traversal algorithms and determine the time and computation complexity.

Syllabus

Module I

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations, Abstract Data Types and their Characteristics; Algorithms: Definition, Characteristics, Analysis of an Algorithm, Asymptotic Notations, Time-Space tradeoffs.

Searching : Linear Search, Binary Search techniques and their complexity analysis.

Module II: (

Stacks and Queues : ADT Stack and its operations : Algorithms and their complexity analysis, Applications of Stacks and multiple stacks: Expression Conversion and evaluation - corresponding algorithms and complexity analysis. ADT queue, Types of Queue : Simple Queue, Circular Queue, Operations on each type of Queues : Algorithms and their analysis. Double Ended Queues and Priority Queues.

Module III:

Linked Lists : Singly linked lists : Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue; Doubly linked list : operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees : Basic Tree Terminologies, Different types of Trees: Binary tree, Binary Search Tree, Tree operations on each of the trees and their algorithms with complexity analysis; Applications of Binary Trees; B Tree, B + Tree: definitions, characteristics and operations; Threaded Binary Tree, AVL Tree: Introduction and applications.

Module IV:

Sorting and Hashing: Objective and properties of different sorting algorithms: Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods; Hashing: Introduction and

Significance, Closed and Open Hashing, Collision Resolution Techniques.
Graph : Basic terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text Books :

1. Ellis Horowitz, Sartaj Sahni & Susan Anderson - Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008
2. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002

Reference Books :

1. Thomas H. Corment, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein; Introduction to Algorithms;' Third Edition; PHI Learning; 2009.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran; Fundamentals of Computer Algorithms; Second Edition; Universities Press; 2008.
3. G. A. V. Pai; Data Structures and Algorithms: Concepts, Techniques and Application; First Edition; McGraw Hill; 2008.

Syllabus of Semester III, Bachelor of Engineering

Course Code: CHT251 **Course : Environmental Studies**
L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 0**

Course Outcomes :

1. Students will get sufficient knowledge regarding different types of environmental pollutions, their causes and detrimental effects on environment. This will highlight the extent of pollution in the surrounding we live and its major causes.
2. Students will realize the need to change their approach so as to perceive our environmental issues correctly, using practical approach based on observations and self learning.
3. Student becomes conversant with recent waste management techniques such as E-waste recycling and management.
4. Students will gain knowledge about the modes for sustainable development, importance of green energy and processes leading to sustainability such as green chemistry.
5. At the end of the course, it is expected that student will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be taken to protect the environment from getting polluted. This will enable human being to live in more sustainable manner.

Syllabus

Principle of contaminant behavior and recent trends in environmental pollution control

Module I- Air pollution and its control techniques: (4 Hrs)

Contaminant behaviour in the environment, Air pollution due to SOx, NOx, photochemical smog, Indoor air pollution

Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle.

Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs).

Techniques to control Air pollution, Ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

Module II- Noise pollution and its control techniques: (2 Hrs)

Introduction to noise pollution and its causes

Noise pollution control: Recent advances in noise pollution control and benefits.

Module III- Soil pollution and its control techniques: (5 Hrs)

Soil pollution: Soil around us, Soil water characteristics, soil and pollution.

Solid waste management: Composting, vermiculture, landfills, hazardous waste treatment, bioremediation technologies, conventional techniques (land farming, constructed wetlands), and phytoremediation.

Degradation of xenobiotics in environment: Petroleum hydrocarbons, pesticides, heavy metals

Module IV-Water pollution and its control techniques: (6 Hrs)

Major sources of water pollution: Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and

tanning, marine pollution, microplastics

Techniques to control water pollution: Conventional waste water treatment-(types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal).

Case studies: (2 Hrs)

Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills

Module V- E-waste (2 Hrs)

Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

Module VI- Environmental Sustainability: Role of Green technology (5 Hrs)

Concept of green technologies, categories, goals and significance, sustainability Green energy, green chemistry, challenges to green technology, advantage and disadvantages of green processes, Eco mark certification- its importance and implementation

Different government initiatives (2 Hrs)

Reference Books :

1) Benny Joseph, Environmental Studies (Second Edition), Mc Graw Hill Education (India) Private Limited
2) B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3) P Aarne Vesilind, J. Jeffrey Peirce, Ruth F. Weiner, Environmental Pollution and Control,3rd Edition Imprint: Butterworth-Heinemann, Published Date : 19th September 1990.
4) D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd. Sultan Chand & Company
5) Microbial Degradation of Xenobiotics, Editiors : Singh, Shree Nath , Springer-Verlag Berlin Heidelberg.
6) Anastas, P.T. & Warner, J.C. 1998, Green Chemistry: Theory & practice, Oxford University Press.
7) Thangavel, P. & Sridevi, G. 2015, Environemental Sustainability: Role of Green technologies, Springer publications

Syllabus of Semester IV, Bachelor of Engineering

Course Code: ENT254 **Course : Digital Signal Processing**

L: 03 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

Upon the completion of this course, students will demonstrate the ability to:

1. Represent discrete time signals in different forms and analyze the LTI system in frequency domain.
2. Process the signal in z domain for various discrete time systems
3. Understand the filter design techniques for discrete time, IIR and FIR filter and will be able to determine parameters affecting its response and draw the structures of filters.
4. Analyze the various finite world length effects while rounding and truncating the signal, understand DSP hardware and DSP applications.

Syllabus:

Module I: (4 Hrs) : Discrete Time Fourier Transform (DTFT): Analysis of LTI system using DTFT, block diagram and signal flow graph representation of linear constant coefficient difference equations

Module II: (7 Hrs) : Z-transform: Z-transform and its properties, analysis of LTI discrete time system using Z transform, Relation between Laplace and Z transform, Inverse Z-transform, Unilateral Z- transform.

Module III: (7 Hrs) : Discrete Fourier Transform (DFT): Frequency Domain sampling, DFT and its properties, filtering of long data sequences using overlap-save method and overlap-add method, Radix-2 Fast Fourier Transform (FFT) algorithms

Module IV: (7 Hrs) : Design of FIR filter: Digital filter concepts, FIR filters Design techniques: Fourier series, Windows (Rectangular, Bartlett, Hanning, Hamming, Blackman, Kaiser) and Optimal frequency sampling, structures for FIR systems

Module V: (5 Hrs) : Design of IIR filter: Impulse invariance transformation, Bilinear Transformation, Design of Butterworth and Chebyshev filters, structures for IIR systems.

Module VI: (5 Hrs) : DSP hardware and Finite word length effects: Quantization by truncation and Rounding, Quantization of Input data and filter coefficients, Digital Signal Processing applications, introduction to DSP processors.

Text Book :

1. Digital Signal Processing: Principles, Algorithms & Applications, John G. Proakis & Dimitris G. Manolakis, PHI, 4th Edition

Reference Books :

1) Digital Signal Processing: A Computer based Approach, Sanjit K. Mitra, 4th Edition Mc-Graw Hill
2) Discrete Time Signal Processing, Alan V. Oppenheim & Ronald W. Schafer, 3rdEdition, Pearson
3) Digital Signal Processing, Thomas J. Cavicchi, Wiley Publication, Student Edition
4) Digital Signal Processing, A NagoorKani, 2nd Edition Mc-Graw Hill

Syllabus of Semester IV, Bachelor of Engineering

Course Code: ENT255 **Course : Analog Circuits**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 4**

Course Outcomes :

Upon the completion of this course, students will demonstrate the ability to:

1. Describe operating principle and analyze differential amplifier.
2. Calculate performance parameters of operational amplifier and design basic linear and nonlinear Op-amp circuits.
3. Design and analyze Op-amp based electronic circuits, Oscillators, Filters, waveform generators and comparators.
4. Use timer IC 555, ADC/DAC and PLL IC 565 for designing electronic circuits for desired applications.

Syllabus

Module I: (8Hrs)

Differential amplifier: Basic differential amplifier and its operation using MOS transistor, dc characteristics, operation with common mode and differential mode input voltage, common mode gain , differential mode gain and CMRR, Constant current source and current mirror circuits, output stages, design of differential amplifier for given specifications.

Module II: (7 Hrs)

Op-amp fundamentals: Characteristics of operational amplifier, open loop Op-amp, basic inverting and non-inverting Op-amp amplifiers with negative feedback, Op-amp parameters & their analysis.

Module III: (8 Hrs)

Op-amp linear applications: Voltage follower, summing amplifiers, integrators and differentiators, log,antilog circuits, difference amplifiers & instrumentation amplifiers, Current to voltage and voltage to current converters.

Module IV: (8 Hrs)

Oscillators and Active filters design: Precision rectifiers, oscillators: basic concept, transistorized sinusoidal oscillators, Op-amp based sinusoidal oscillators, design of Active filters.

Module V:(7 Hrs)

Op-amp Non-linear applications: Clipper, Clamper, Comparators, Schmitt trigger circuits, Comparator IC 339,Triangular wave generator, multivibrator circuits using op-amps, Sample/Hold circuits, Digital to analog converters, Analog to digital converters.

Module VI: (7 Hrs)

Timer and PLL ICs: Timer IC 555: Internal block schematic, multivibrator configurations, PLL & its applications. Basic concept and configurations of Switched capacitor circuits.

Text Book :

1. Microelectronics Circuits: Theory and applications: A. S. Sedra, Kenneth C.Smith, Arun N. Chandorkar, Seventh Edition, Oxford university Press,2017.

Reference Books :

1) Linear Integrated Circuits: D. Roy Choudhary, Shail Jain, 4th Edition, New Age International.
2) Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition: Sergio Franco, TMH,
3) Operational Amplifiers: G. B. Clayton,5th Edition, International Edition
4) Operational Amplifiers and Linear Integrated Circuits, 4th Edition: Coughlin Driscoll,PHI
5) Introduction to Operational Amplifier theory and applications: J.V.Wait, L.P.Huelsmanand G A Korn, McGraw Hill,1992
6) Electronic Circuits: Analysis and design: Donald Neaman,.third Edition, McGraw Hill,2006

Syllabus of Semester IV, Bachelor of Engineering

Course Code: ENT256 **Course : Microprocessor and Microcontroller**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

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

1. Understand the architecture of microprocessor & microcontroller.
2. Develop, understand and Analyze programs, select appropriate machine and cross assembler utility of a microprocessor and microcontroller.
3. Acquire the knowledge, techniques & skill to interface external peripheral devices with microprocessor or microcontroller.
4. Design microcontroller-based system to solve the real world problem.

Syllabus

Module I: (4Hrs)

8085 architecture and Instructions: Introduction to RISC and CISC processors, Harvard and Von Neumann architecture, Introduction to Intel's 8085, architecture, pin diagram, bus concepts, addressing modes. Instruction set, stack and subroutines- simple & nested, stack manipulation, simple programs.

Module II: (5Hrs)

8085 Timing diagram and Interrupts: Timing diagram sof 8085, Memory mapping, interrupts-concept and structure, interrupt service routines, interrupt programming of 8085.Architecture and interface of 8255 with 8085.

Module III: (6Hrs)

Introduction to Intel's x 86: Introduction to Intel's x86 processor architecture, segmentation, pipelining, addressing modes, memory architectures and management.

Module IV: (7Hrs)

Introduction of Microcontroller: x51 Family Microcontrollers, their Architecture & programming.

Module V:(7Hrs)

Interfacing with x51: Interfacing of Switches & Relays, Stepper motor, LED, SSD, LCD, Analog-to-Digital Converter (ADC), DC motor. Power management in x51controller: Sleep mode, idle mode, Run Mode.

Module VI: (6Hrs)

Commutation Protocols: I/O Port Expansion using RS232, RS422, RS485, Serial Peripheral Interface (SPI), Synchronous Serial Port (SSP) Module, I2C Communication.

Text Books :

1. Microprocessor: Architecture, Programming & applications with 8085; Ramesh S.Gaonkar; Penramth International, 5 Edition.
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C; Muhammad Ali Mazidi, 2nd Edition, Pearson

Reference Books :

1) 8085 Microprocessor: Programming and Interfacing; N. K. Srinath; PHI, 1 Edition.
2) Microcomputer systems: the 8086/8088 family: Architecture, Programming, and Design; Yu-chengnd Liu, Glenn A. Gibson; Prentice-Hall, 2 Edition.
3) Advanced Microprocessors and Peripherals; A. K. Ray & K. M. Bhurchandi; McGraw Hill, 3rdEdition.

Syllabus of Semester IV, Bachelor of Engineering

Course Code: ENT257 **Course : Electromagnetic Fields**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

Upon the completion of this course students will be able to:

1. Define and recognize different coordinate systems to describe the spatial variations of the physical quantities dealt in electromagnetic field theory.
2. Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields in different media.
3. Understand the working principle of electromagnetic energy conversion and electromagnetic energy storage devices.
4. Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information thus creating a base for Microwave Engineering.

Syllabus:

MODULE I: (3 Hrs)

Introductory Mathematical Preliminaries: Introduction to Cartesian, Cylindrical and Spherical coordinate systems, Divergence, Divergence Theorem.

MODULE II: (7 Hrs)

Time Invariant Electric Fields: Electric field intensity, flux density, Gauss's law& its Application, Electric potential and potential gradient, Materials in the Electric Field, Interface Conditions, Capacitance, Energy in the Electrostatic Field, Boundary Value Problems: Analytic Methods of Solution, Laplace & Poisson's equation.

MODULE III: (7 Hrs)

Time Invariant Magnetic Fields: Current density and continuity equation, Biot-Savart's law, Ampere's circuital law and applications, Magnetic flux and Flux density, Boundary conditions, Classification of Magnetic Materials

MODULE IV: (4 Hrs)

Introduction To Time-Varying Fields: Faraday's law in integral and differential form, Ohm's law, Lenz's law, electromotive force (emf) and work, inductance (mutual and self), displacement current.

MODULE V: (7 Hrs)

Maxwell's Equations: Maxwell's equations for steady fields, Maxwell's equations for time varying fields. Interface Conditions for the Electromagnetic Field,Electromagnetic wave equation, wave propagation in free space, in a perfect dielectric and perfect conductor, skin effect, Scalar and Vector magnetic potentials.

MODULE VI: (7 Hrs)

Electromagnetic Waves: Poynting vector, Poynting theorem, reflection and refraction of uniform plane wave at normal incidence plane, reflection at oblique incident angle, polarization.

Text Book :

1. Field and Wave Electromagnetics: David Cheng, Pearson India, 2nd Edition, 2014

Reference Books :

1. Fundamentals of Applied Electromagnetics: Fawwaz T. Ulaby, Umberto Ravaioli, Pearson India, 6th edition, 2014.
2. Engineering Electromagnetics: Nathan Ida, Springer Science 2nd Edition, 2008.
3. Principles of Electromagnetics: Matthew N. O. Sadiku, 6th edition.
4. Engineering Electromagnetics: William Hayt, John. R. Buck, Mc-Graw Hill Education, India, 8th Edition.
5. Electromagnetic Waves and Radiating Systems: Edward C. Jordan, Keith G. Balmain, Pearson India, 2nd Edition 2015.
6. Electromagnetics with Applications: John Kraus, Mc-Graw Hill Education, India, 5th Edition, 1999.

Syllabus of Semester IV, Bachelor of Engineering

Course Code: IDT254 **Course : Biological Science**
L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :
Upon the completion of this course students will be able to
1. Understand the basics of biology regarding the life structures and process.
2. Understand the principles of energy transaction in living systems.
3. Understand the process of generation of Bioelectric signals, Bioelectric Devices and recent advances in Biosciences.

Syllabus:
MODULE I: (6 Hrs)
Introduction : Engineering perspective of Biological Sciences, Fundamental differences between science and Engineering- case studies; Hierarchy and classification of life forms, Levels of organization of life- cell, tissues, organs, system and organism ,Anatomy and physiology.

MODULE II: (6 Hrs)
Biomolecules and Enzymes: Biomolecules as basic building block of all forms of life, structure and function of carbohydrates, proteins and Amino acids, Lipids, Nucleic acids, Vitamins and Minerals, Enzymology- Introduction, classification and mechanism of action

MODULE III: (6 Hrs)
Metabolism /Bioenergetics: Fundamental principles of energy transactions (Thermodynamics) as applied to biology, Entropy changes in biological systems, free energy, equilibrium, process of synthesis and breakdown of glucose.

MODULE IV: (6 Hrs)
Genetics: Introduction to Genetics, genetic codes, Expression and Transmission of genetic Information, concept of DNA cloning , single gene disorders in humans**.**

MODULE V: (6 Hrs)
Bioelectric signals and devices: Resting and action potential, propagation of bioelectric signals, various bioelectric signals- ECG,EEG,EMG; Electrode electrolyte interface, Biosensors and Diagnostic devices.

MODULE VI: (5 Hrs)
Advance Topics in Biosciences: Current trends in the field of cell and Molecular biology, Biomimetics, Bioinformatics, Nanobiotechnology**.**

Text Book :
1. Biology: A Global Approach: Campbell,N.A.;Reece,J.B;Urry,Lisa; Cain, M,L; Wasserman,S.A.; Minorsky, P.V.; Jackson, R.B.Pearson Education Ltd.

Reference Books :
1. Molecular Cell Biology. W. H. Freeman.: LodishH,BerkA,Zipursky SL, et al. (2000)
2. Lehninger Principles of Biochemistry.: Lehninger,A.L.,Nelson ,D.L., & Cox, M.M(2000) . Newyork; Worth Publishers
3. Genes VII: Lewin B.(2000). Oxford University Press.
4. Medical Instrumentation Application and Design: John G. Webster, ,4th edition, Wiley India,2015

Syllabus of Semester IV B.E. (Electronics Engineering) Minor Specialization

Course Code: ENTM 41/ EDTM 41 **Course: : Fundamentals Of Electronic Devices And Circuits**
L:04 Hrs.,T:0Hrs.,P:0Hrs.,Per week **Total Credits:4**

Course Objectives:
Upon the completion of this course students will be able to:
1. Understand the basics and importance of semiconductor and its devices in field of electronics
2. Examine and formulate use of electronic devices in different analog applications
3. Recognize concept of feedback, its impact in practical circuits
4. Investigate practical operational amplifier circuit and its applications

Syllabus:
Module I: (9 Hrs)
Origin of Electronics: Semiconductor: Uniqueness of semiconductor materials, Energy bands, Intrinsic vs. Extrinsic, Electrical properties like mobility, conductivity, etc. Conduction in semiconductors, P-N junction characteristics, Quantitative and qualitative analysis of PN diode, Basics of photo-diode, Zener diode *etc.*

Module II: (9 Hrs)
Diode Applications: DC power supply design – Rectifier, Regulator, non-ideal switch.
Bipolar Junction Transistors: Device structure and Physical Operation, Current Components in BJT, different configuration, Need of Biasing, Bias Stability, BJT as CE Amplifier and its practical analysis

Module III : (9 Hrs)
MOSFETS: Importance of FET structures, – small signal model and analysis, Volt-Ampere Characteristics, MOS Amplifier: Biasing, operating point selection, Single stage MOSFET amplifier, MOS as Switch, SR model, signal restoration, gain, and nonlinearity

Module IV: (9 Hrs)
Feedback in Amplifier: negative feedback properties: Gain de-sensitivity, bandwidth extension, noise reduction *etc.* Basic Feedback Topologies, Practical circuits and analysis, Oscillators and its stability criteria, Mutivibrators and its applications

Module V: (9 Hrs)
Operational-Amplifier and Data-Converter Circuits: Two-Stage CMOS Op Amp, 741 Op-Amp practical circuits, Amplifier configurations properties like Gain, Frequency Response, and Slew Rate etc., A/D and D/A Data Converters

Text Books :
1. Microelectronics Circuits: Theory and Applications : Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Seventh Edition, Oxford University Press, 2017.
2. Millman's Integrated Electronics: Jacob Millman, Christos Halkias, Chetan Parikh, Second edition, McGraw Hill Education, 2017.

Reference Books:
1. Foundations of Analog and Digital Electronic Circuits: Anant Agarwal and Digital Electronic Circuits, Morgan Kaufman Publishers (Elsevier), 1st Edition, 2005
2. Electronic Circuits: Analysis and Design: Donald Neamen, Third Edition, McGraw-Hill Publication, 2006.
3. Electronic Devices and Circuits: David A. Bell, Fifth Edition, Oxford 2008.

Open Elective Syllabus of Semester V/VII B.E

Course Code: : **ENT 298-1/ ENT 398-1** **Course :** S**mart Agriculture (open Elective)**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

Upon completion of this course, Students will be in position to understand

1. Soil science, Plant anatomy and health monitoring
2. Sensors and actuators for farming tools , sensor data acquisition and telemetry
3. Advanced technologies for smart farming

Syllabus

Module I: (6Hrs)

Soil Science: Nature and origin of soil; soil minerals, classification and composition, soil reaction, soil properties including structure, PH, surface tension and soil nutrient

Module II: (6 Hrs)

Sensors: Classification and characteristics, Smart sensors, Colorimetry based detection, MEMS Electrochemical Sensors, Dielectric Soil Moisture Sensors, ISFET, Weather sensors, Proximity Sensors, Signal conditioning and converters.

Module III: (6 Hrs)

Actuators for tool automation: A.C.-D.C. Motors, Stepper motor, Solenoid actuators, Piezoelectric motors, Electric drives, Hydraulic and Pneumatic actuator

Module IV:(6 Hrs)

Telemetry: Wireless communication modules and topology, Zig-bee, Bluetooth, LORA, Zero power devices, Energy Harvesting technology

Module V: (5 Hrs)

Plant health monitoring: Measurement of leaf health, chlorophyll detection, ripeness level, crop mapping, fertilizing, Drone technology for soil field analysis and assistive operations.

Module VI: (6 Hrs)

Technologies for farming: Water quality monitoring, micro-irrigation system, solar pump and lighting system, Fencing, Android based automation, Agricultural Robots, Standards for agriculture.

Text Books :

1. The nature and properties of Soils: Eurasia Publishing House Pvt Ltd, New Delhi Brady, Nyle C. (1988).
2. Measurement Systems; Application and Design: Doeblin, D.O. McGraw Hill, 1984.

Reference Books :

1) Smart Agriculture: An Approach towards Better Agriculture Management: Editor: Prof. Dr. Aqeel-ur-Rehman, OMICS Group,
2) Practical MEMS: Design of microsystems, accelerometers, gyroscopes, RF MEMS, optical MEMS, and microfluidic systems: Ville Kaajakari, Small Gear Publishing
3) Principles of Industrial Instrumentation: Patranabis. D, Tata McGraw Hill, 1995
4) Mechatronics: Bolton, W. 2004.Pearson Education Asia
5) Photo-voltaic energy systems: Design and Installation: Buresch, Mathew. 1983. McGraw-Hill Book Company, New York.

Open Elective Syllabus of Semester V/VII B.E

Course Code: : ENT 298-2/ ENT 398-2 **Course : Arduino Playground**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

Upon completion of this course, Students will be able to demonstrate the ability to

1. Create sketches, libraries inside the Arduino Development Environment.
2. Measure various physical parameters using sensors.
3. Implement various communication protocols for wired and wireless communication.

Syllabus

Module I: Arduino Cram Session (5 Hrs)

Arduino platform, Prototyping environment, Electronic component overview, Arduino Development Environment, setting up the Arduino board, creating sketches, using Libraries, using example codes, Debugging using the Serial Monitor.

Module II: Let Us (Arduino) C (6 Hrs)

Arduino C, Data types, Decision making, Loops, Functions, Pointers, Structures

Module III: Sensing the World (6 Hrs)

Sensors, Digital and Analog signals, Temperature sensors, Humidity sensors, Obstacle sensors, Ultrasonic sensor, Accelerometer and gyro

Module IV: Communicating with the world (6 Hrs)

Wired and Wireless communication, Communication Protocols, Interfacing Communication Modules with Arduino.

Module V: Playing with Displays (6 Hrs)

Interfacing Alphanumeric LCD Display, Formatting Text, Creating Custom Characters, Interfacing Graphical LCD Display, creating Bitmaps for Use with a Graphical Display.

Module VI: Making Noise (6 Hrs)

Playing Tones, Playing a melody, Types of motors - DC, Servo, Stepper, Motor Drivers, Speed and direction control.

Text Books :

1. Arduino Cookbook by Michael margolis, O'Reilly Media, Ic., 1st edition.
2. Beginning C for Arduino by Jack Purdum (ebook)
3. Arduino for Beginners: Essential Skills Every Maker Needs, John Baichtal, Pearson Education, Inc.,1st edition

Open Elective Syllabus of Semester V/VII B.E

Course Code: : ENT 298-3/ ENT 398-3 **Course : Consumer Electronics**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

Upon completion of this course, Students will be able to demonstrate the ability to

1. Understand electronics engineering concepts used in consumer electronics system.
2. Identify the need of preventive maintenance in various electronic appliances.
3. Use different product safety, compliance standards and techniques associated with electronic products.
4. Evaluate and analyze different electronic products and systems based on specifications.
5. Manage multi-faceted and multi-disciplinary projects with significant technical considerations using a broad systems perspective.
6. Foster a desire to continue life-long learning.

Syllabus

Module I: (7 Hrs)

Audio System : Microphones, loudspeakers baffle and enclosure, Acoustics, mono, stereo, Quad, Amplifying System, Equalizers and Mixers Synthesizers, Commercial sound, Theater Sound System.

Module II: (7 Hrs)

Video Systems and Displays : Monochrome, Color TV standards, TFT, Plasma, HDTV, LCD, LED TV, Direct-To-Home (DTH- Set Top Box), Video Telephone and Video Conferencing.

Module III: (7 Hrs)

Domestic & Consumer Appliances : Washing machines, Microwave ovens, Air-conditioners and Refrigerators, Computer office System, Telephone & Mobile Radio System.

Module IV: (7 Hrs)

Power supplies SMPS/UPS and Preventive Maintenance and other systems such as Remote controls, Bar Codes, RFID.

Module V: (7 Hrs)

Product Compliance: Product safety and liability issues; standards related to electrical safety and fire hazards, EMI/EMC requirements, design techniques for ESD, RF interference and immunity, line current harmonics and mains voltage surge.

Text Books :

1. Consumer Electronics; SP Bali; Pearson Education.
2. Consumer Electronics; J. S. Chitode; Technical Publications, Pune

Open Elective Syllabus of Semester IV/VI B.E

Course Code: : **ENT 299-1/ ENT 399-1** **Course : Industrial Automation**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

After successfully completing the course students will be able to

1. Understand process control, PLC architecture and interfacing
2. Develop PLC ladder logic for industrial applications
3. Design Automation systems for industrial applications

Syllabus

Module I: (5Hrs) Process Control & Automation: Process control principles, Analog and Digital control, Types of Automation; Architecture of Industrial Automation Systems, Advantages and limitations of Automation, Industrial revolutions

Module II: (5 Hrs) Signal Conditioning and Transmitters: Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for sensors, Smart and Intelligent transmitters

Module III: (5 Hrs) Controllers and Actuators: PID Controller, Mechanical switches, Solid-state switches, Electrical actuators: Solenoids, Relays and Contactors, AC Motor, energy conservation schemes through VFD, DC Motors, Servo Motor, Pneumatic and hydraulic actuators.

Module IV:(8 Hrs) PLC: Functions of PLC, Architecture, Selection of PLC, Networking of PLCs, Ladder Programming, Interfacing Input and Output devices with PLC, PLC based automated systems. High frequency inputs. PLC programming standard IEC61131

Module V: (6 Hrs) SCADA & Distributed control system: Elements of SCADA, Features of SCADA, MTU, RTU Functions, Applications of SCADA, Communications in SCADA, Introduction to DCS, Architecture, Input and output modules, Specifications of DCS.

Module VI: (6 Hrs) Industrial Communication and Human Machine Interface (HMI): Device network: CAN, PROFIBUS-PA, Control network: ControlNet, PROFIBUS-DP, Ethernet, Interfaces: RFID, Barcode, HMI: Block Diagram, Types, Advantages and industrial applications.

Text Book :

1. Programmable Logic controllers and Industrial Automation: Madhu chhanda Mitra, Samarjit Sen Gupta, Penram International Publishing India Pvt. Ltd

Reference Books :

1) Programmable Logic Controllers, Principles and Applications: John W. Webb, Ronold A Reis, 5th Edition, Prentice Hall of India Pvt. Ltd
2) Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication
3) Process Control Instrumentation Technology: Curtis Johnson, 8th Edition, Pearson Education

Open Elective Syllabus of Semester IV/VI B.E

Course Code: : **ENT 299-2/ ENT 399-2** **Course : Micro -Nano System**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

After successfully completing, the course students will,

1. Gain knowledge of MEMS and its application in sensor and actuator
2. Nano material, and manufacturing of Nano electronic devices.
3. Understand various measuring techniques and tools.

Syllabus

Module I: (6Hrs)

Introduction to MEMS: Miniaturization, Types of beams and deflection of beams, Micromachining technology, Thin film deposition, sputtering methods, etching process.

Module II: (6 Hrs)

MEMS sensors and actuators: Piezoresistive sensing andactuation, Electrostatic sensors and actuators, Thermal sensing and actuation, Magnetic actuation, MEMS applications.

Module III: (6 Hrs)

Materials in Nano Electronics: Band structures in Silicon, Basics of crystal structure, defects, crystal growth and wafer fabrication, crystal planes and orientation. Modern CMOS technology

Module IV:(6 Hrs)

Semiconductor Nano Electronics: Wafer contaminations, Wafer cleaning methods, Lithography: basic concepts of optics, photoresists, wafer exposure systems, methods and equipment, Thermal Oxidation

Module V: (6 Hrs)

Nano Electronic Devices: Single Electron devices and Transistors, Quantum particle, Quantum Dot, Logic circuits using quantum dots, nano-wires construction and applications, FinFETs, construction and properties

Module VI: (5 Hrs)

Measurements methods and tools: IV/CV characterization, Hot probe method, Sheet resistance, Physical measurements: Electron microscopy, Atomic Force Microscope, X-Ray photoelectron Spectroscopy, Profilometers

Text Books:

1. Foundations of MEMS: Chang Liu, Pearson Education.
2. Fundamentals of Nanoelectronics: George W Hanson, Pearson education

Reference Books:

1) NanoelectronicsDevices: Byung-Gook Park, Sung Woo Hwang, Young June Park, Pan Stanford Publishing Pte. Ltd.
2) Silicon VLSI Technology, Fundamentals, Practice and Modeling: James D Plummer, Michaeld Deal and Peter B Griffin, Pearson Education.
3) Nano Circuit Design: Niraj K. Jha, Deming Chen, Springer

Open Elective Syllabus of Semester IV/VI B.E

Course Code: : **ENT 299-3/ ENT 399-2** **Course : Designing with Raspberry Pi**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 3**

Course Outcomes :

Upon the completion of this course, students will be able to demonstrate the ability to ,

1. Wire Raspberry Pi and create a fully functional computer
2. Use Python-based IDE and trace and debug Python code on the device.
3. Measure physical parameter using sensors.
4. Implement various communication protocols for wired and wireless communication.
5. Interfaces different motors and create robots.

Syllabus

Module I: (6Hrs) Getting started with Raspberry Pi: Basic functionality of the Raspberry Pi and its Processor, setting and configuring the board, differentiating Raspberry Pi from other platform like arduino, begal, asus thinker etc. Overclocking, Component overview.

Module II: (6 Hrs) Introduction to Linux: Implications of an operating system on the behavior of the Raspberry Pi, Overview of Linux and its terminal command, aptget-update, aptget-upgrade, navigating the file system and managing processes, text-based user interface through the shell, overview of graphic user interface.

Module III: (6 Hrs) Programming the Raspberry Pi: Python: Introducing to Python programming language; Python Programming Environment, Python Expressions, Strings, Functions, Function Arguments, Lists, List Methods, Control Flow, Numpy, PIP (Python Installation Package) and customized libraries. **C++ programming :** Basic C++ programming approach, header file structure and library organization, Cross Compiler and its configuration.

Module IV: (6 Hrs) Exploring Electronics with the Raspberry Pi: Communication facilities on raspberry Pi (I2C, SPI, UART), working with RPil. GPIO library, Interfacing of Sensors and Actuators.

Project 2: Set up a Pi motion detector
Project 3: Set up a Pi ADC/DAC
Project 4: Construct a digital weather station
Project 5: Construct a Traffic Light Controller

Module V: (6 Hrs) Communication using Raspberry Pi : Wired and Wireless communication, TCP, IP configurations, SSH, Putty terminal usage.

Project 6: Set up file server
Project 7: Network your keyboard and mouse
Project 8: Create a portable wireless access point
Project 9: Communicate with Arduino
Project 10 : Construct a digital server based weather station

Module VI: (5 Hrs) Robotic Motion PI : DC, Servo, Stepper, Motor Drivers, Motor Shields, Camera Interfacing, remote data logging.

Project 11: Keyboard Control Robot
Project 12: Wireless Robot

Text Books:

1) Raspberry Pi 3 : An introduction to using with Python Scratch, Javascript and more, Gary Mitnick, Create Space Independent Publishing Platform, 2017.
2) Raspberry Pi for Python Programmers Cookbook, Tim Cox, Packt Publishing Limited; 2nd Revised edition, 2016.
3) Raspberry Pi User Guide, Eben Upton and Gareth Halfacree, John Wiley & Sons, 2016.

NOTES

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