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. (ELECTRICAL ENGINEERING)

Published by
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ISO 9001 : 2015 CERTIFIED ORGANISATION

Electrical Engineering Department

Salient Features of Department

- The Department of Electrical Engineering was established in year 1984 with a sanctioned intake of 60 students. The National Board of Accreditation has accredited the department four times in succession in the year 2001,2006, 2012 & 2017. Presently, the Electrical Engineering Department has post graduate program (M. Tech. in Power Electronics and Power Systems) with sanctioned intake of 18, started from 2011. Department is a Recognized Research Centre, approved by RTM Nagpur University for Master of Engineering (M.E.- By Research) and Doctoral program. Department has twelve well-equipped laboratories.
- Department has Two Professors, eight Associate Professors and eleven Assistant Professors on the roll. Department has well qualified and experienced faculty with industrial background. They have undertaken many consultancy projects and have been granted patent by government of India.
- The department has conducive environment for the academic and overall development of the students. The Electrical Engineering Students Association (EESA) is a platform for promoting the curricular, co-curricular and extracurricular students activities. Department students actively participate in sports and represent the college at various levels. Students are keenly interested in contributing for social cause and join the National Service Scheme (NSS) activities. Department organizes Seminars, Guest lectures, Training programs and Product exhibitions for the students. Students get opportunity to enhance their technical skill by participating in the training program like PLC and SCADA .
- To introduce the graduating students to the latest developments in the industry, the department organizes Technical Workshop cum Exhibition named “EMPOWER". This mega event is organized in the department for five times in year 2012, 2013, 2014, 2017 and 2018. Reputed companies namely ABB Limited, ARCTIC Infra Tech, GRANDSTREAM, Grundfos, Hager, Hioki, KEI Cables, L&T, Powerica, Wipro, Bergen, Biosys, HP, Rockwell Automation, Schneider, Siemens, Texas Instruments, Finolex, Highrise Transformers, TDK, Waree, Gentech, Synergy, VSP aqua mist etc. participated in the exhibition with the wide range of products to display. Around 300 students from more than 23 Engineering colleges attended these workshops every year.
- On academic front, the department results are consistently good with students seeking merit positions on the University level. The department has active Entrepreneur Development Cell to develop the entrepreneurial skills among the students. The department highly encourages the industry interaction. Students go for industry training during the vacation.

Department Vision : Department of Electrical Engineering endeavors to be one of the best departments in India having expertise to mould the students to cater the needs of society in the field of technology, leadership, administration, ethical and social values.

Department Mission : To provide dynamic and scholarly environement for students to achieve excellence in core electrical and multidisciplinary fields by synergetic efforts of all stake holders of the Electrical Engineering Department and inculcate the ethical and social values.

Programme Educational Objectives

PEO1 : Our graduates will work on design, operation and practice in electrical fields by addressing intricacies of engineering and technology applications.

PEO2 : Our graduates will work in multidisciplinary fields and adapt to new technologies, new work environments, pursue additional skills and knowledge leading to professional development.

PEO3 : Our graduates will progress in their career by demonstrating in practice the technical and communication skills with an understanding of ethical and social responsibilities.

Programme Outcomes

PO1. **Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals to the solution of engineering problems.

PO2. **Problem analysis :** Identify, formulate, review literature, and analyze complex engineering problems using first principles of mathematics, natural sciences and engineering sciences.

PO3. **Design/development of solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public safety, societal and environmental considerations.

PO4. **Conduct problem investigations :** Use research-based knowledge including experimentation, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage :** Select, and apply appropriate techniques, resources, and modern engineering and IT tools for analyzing the engineering activities with an understanding of the limitations.

PO6. **The engineer, industry and society :** Apply contextual knowledge to assess industrial, societal and safety related issues and understand consequent relevance to the professional engineering practice.

PO7. **Environment and sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO8. **Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work :** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication :** Communicate effectively on complex engineering activities such as, being able to understand and write effective reports, make effective presentations and give and receive clear instructions.

PO11. **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 in multidisciplinary environments.

PO12. **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

PSO1. Analyze and design electrical networks, machines, control systems, power systems, power converters and evaluate the performance.

PSO2. Understand and develop electrical systems considering energy efficiency, power scenario, environmental issues and industry applications.

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. (Electrical 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	MAT256	Electrical Engineering Mathematics	3	0	0	03	40	60	100	3
2	CET271	Engineering Mechanics & Strength of Materials	3	0	0	03	40	60	100	3
3	EET251	Network Analysis	3	1	0	04	40	60	100	3
4	EEP251	Network Analysis Lab	0	0	2	01	25	25	50	3
5	ENT259	Analog Electronic Circuits	3	0	0	03	40	60	100	3
6	ENP259	Analog Electronic Circuit Lab	0	0	2	01	25	25	50	3
7	EET252	Electrical Measurements & Instrumentation	2	1	0	03	40	60	100	3
8	EEP252	Electrical Measurements & Instrumentation Lab	0	0	2	01	25	25	50	3
9	HUT251	Principles of Economics & Management	3	0	0	03	40	60	100	3
10	CHT251	Environmental Sciences	2	0	0	00	-	-	-	-
		TOTAL	**19**	**02**	**06**	**22**				

Scheme of Teaching & Examination of Bachelor of Engineering
IV Semester B.E. (Electrical 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	EET271	Signals & Systems	2	1	0	03	40	60	100	3
2	ENT260	Digital Circuits & Micro Processor	3	0	0	03	40	60	100	3
3	ENP260	Digital Circuits & Micro Processor Lab	0	0	2	01	25	25	50	3
4	EET272	Electrical Machines - I	3	1	0	04	40	60	100	3
5	EEP272	Electrical Machines - I Lab	0	0	2	01	25	25	50	3
6	EET273	Programming for EE Applications	3	0	0	03	40	60	100	3
7	EEP273	Programming for EE Applica- - tions Lab	0	0	2	01	25	25	50	3
8	EET299	**Open Elective - I**	3	0	0	03	40	60	100	3
9	EET275	Electromagnetic Fields	3	0	0	03	40	60	100	3
10	HUT252	Indian Traditional Knowledge	2	0	0	00	--	--	--	--
		TOTAL	**19**	**02**	**06**	**22**				

Open Elective - I	
EET 299-1	Consumer Electrical Appliances
EET 299-2	Renewable Energy Systems

Scheme of Teaching & Examination of Bachelor of Engineering
V Semester B.E. (Electrical 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	EET351	Power System-I	3	0	0	03	40	60	100	3
2	EET352	Electrical Machines-II	3	1	0	04	40	60	100	3
3	EEP352	Electrical Machines-II Lab	0	0	2	01	25	25	50	3
4	EET353	Microcontroller	3	0	0	03	40	60	100	3
5	EEP353	Microcontroller Lab	0	0	2	01	25	25	50	3
6	EET354	Program Elective-I	3	0	0	03	40	60	100	3
7	EET355	Power Electronics	3	1	0	04	40	60	100	3
8	EEP355	Power Electronics Lab	0	0	2	01	25	25	50	3
9	EET398	**Open Elective-II**	3	0	0	03	40	60	100	3
10	EEP357	Electrical Workshop & CAEED Lab	0	0	2	01	25	25	50	3
		Total	18	02	08	24				

Program Elective - I		Open Elective - II	
EET354-1	Electrical Machine Design	EET398-1	Energy Management & Audit
EET354-2	Non Conventional Energy Sources	EET398-2	Microcontroller Applications
EET354-3	Electric Energy Conservation & Audit	EET398-3	Industrial Instrumentation
EET354-4	Industry Offered Elective - I		

Scheme of Teaching & Examination of Bachelor of Engineering
VI Semester B.E. (Electrical 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	EET371	Power System-II	3	0	0	03	40	60	100	3
2	EEP371	Power System - II Lab	0	0	2	01	25	25	50	3
3	EET372	Control System	3	1	0	04	40	60	100	3
4	EEP372	Control System Lab	0	0	2	01	25	25	50	3
5.	EET373	Program Elective - II	3	0	0	03	40	60	100	3
6.	EET374	Program Elective-III	3	0	0	03	40	60	100	3
7.	EET399	**Open Elective-III**	3	0	0	03	40	60	100	3
8.	EEP376	E Circuit Design & Testing Lab	0	0	2	01	25	25	50	3
9.	EEP377	Comprehensive Viva	0	0	2	01	25	25	50	3
		TOTAL	**15**	**01**	**08**	**20**				

Program Elective - II		Program Elective - III		Open Elective - III	
EET373-1	PLC & SCADA	EET374-1	Electrical Drives & Control	EET 399-1	Solar Photovoltaic Systems
EET373-2	Power Station Practice	EET374-2	HVDC Transmission System		
EET373-3	Utilization of Electrical Energy	IDT352	Biology for Engineers	EET 399-2	Automation with PLC
EET373-4	Industry Offered Elective - II	EET374-3	Industry Offered Elective - III		

Scheme of Teaching & Examination of Bachelor of Engineering
VII Semester B.E. (Electrical 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	EET451	High Voltage Engineering	3	0	0	03	40	60	100	3
2	EEP451	High Voltage Engineering Lab	0	0	2	01	25	25	50	3
3	EET452	Program Elective-IV	3	0	0	03	40	60	100	3
4	EET498	**Open Elective-IV**	3	0	0	03	40	60	100	3
5	MBT451	Entrepreneurship Development	3	0	0	03	40	60	100	3
6	EEP454	Industry Internship Evaluation	0	0	2	00	50	–	50	–
7	EEP455	Project Phase - I	0	0	6	03	100	–	100	–
		TOTAL	**12**	**00**	**10**	**16**				

Program Elective - IV		Open Elective - IV	
EET452-1	Advance Electric Drives & Vehicles	EET498-1	Electrical Vehicles
EET452-2	Computer Application in Power System	EET498-2	Industrial IOT Instrumentation & Connectivity
EET452-3	Advanced Control Systems		
EET452-4	EHVAC Transmission Systems		
EET452-5	Industry Offered Elective - IV		

Scheme of Teaching & Examination of Bachelor of Engineering
VIII Semester B.E. (Electrical 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	EET471	Power System Protection	3	0	0	3	40	60	100	3
2	EEP471	Power System Protection Lab	0	0	2	1	25	25	50	3
3	EET472	Program Elective - V	3	0	0	3	40	60	100	3
4	EET473	Program Elective-VI	3	0	0	3	60	40	100	3
5	EET474	Project Phase-II/One Semester Industry Project / Incubation	0	0	16	8	100	100	200	-
		TOTAL	**9**	**00**	**18**	**18**				

Program Elective - V		Program Elective-VI	
EET472-1	Digital Signal Processing	EET473-1	Power Quality & FACTS
EET472-2	EHV Substation Design & Erection	EET473-2	Industrial Electrical System
EET472-3	Mechatronics	EET473-3	Fuzzy Logic & Neural Networks
EET472-4	Industry Offered Elective - V	EET473-4	Industry Offered Elective - VI

Scheme of Teaching & Examination of Bachelor of Engineering
Honors Specialization (Electrical 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	EETH41	DC Microgrid	4	0	0	4	40	60	100	3
2	EETH51	Introduction to Smart Grid	4	0	0	4	40	60	100	3
3	EETH61	Advance Power Electronics and Control	4	0	0	4	40	60	100	3
4	EETH71	Mathematical Methods and Techniques in Signal Processing	4	0	0	4	40	60	100	3
5	EETH81-1	Advanced Linear Continuous Control Systems: Applications with MATLAB Programming and Simulink	4	0	0	4	40	60	100	3
6	EETH81-2	Mapping Signal Processing Algorithms to DSP Architectures	4	0	0	4	40	60	100	3
7	EETH81-3	Power System Analysis	4	0	0	4	40	60	100	3
8	EETH81-4	Power System Dynamics, Control and Monitoring	4	0	0	4	40	60	100	3

Scheme of Teaching & Examination of Bachelor of Engineering
Minors Specialization (Electrical 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	EETM41	Electrical Machines	4	0	0	4	40	60	100	3
2	EETM51	Power Semiconductor Based Drives	4	0	0	4	40	60	100	3
3	EETM61	Renewable Energy Sources	4	0	0	4	40	60	100	3
4	EETM71	Power system	4	0	0	4	40	60	100	3
5	EETM81	Power system protection	4	0	0	4	40	60	100	3

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, $F = -\nabla V$; 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(s):

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 I / II, B.E

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. 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 succesive phase difference; Damped oscillations, under, critical and over-damping with stress on mechanical oscillators, problems; Forced oscillations with focus on mechanical oscillations, impedance of a 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 logitudinal 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 $|\overline{E}|/|\overline{H} \perp E|$ 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,ψ, for matter waves and its interpretation, position and momentum operators, Hamiltonian operator, Schrodinger's equation; One-dimensional single particle systems: Particle in an 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, B.E

(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 (8L)

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 and finite square well potentials: formulae, function graphs, number of bound states, Atomic orbitals, Concept of molecular bonding via overlap of orbitals and formation of molecular anti-bonding and bonding energy levels and wave functions: Qualiitative description only.

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 classication of electronic materials: metals, semiconductors, and insulators, E-k diagram, Direct and indirect bandgaps.

Module 3: Electrons in Semiconductors (4L)

Valence and conduction bands, Density of states, Fermi-Dirac statistics: Occupation probability of states, Fermi level, Effective mass, Phonons.

Module 4: Intrinsic and Extrinsic Semiconductors (6L)

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diusion and drift, p-n junction, Continuity equation, Metal-semiconductor junction (Ohmic and Schottky).

Module 5: Light - Semiconductors Interaction (6L)

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain, Semiconductor materials of interest for optoelectronic devices; Photovoltaic effect, Exciton, Drude model, LED, Photodiode.

Module 6: Engineered Semiconductor Materials (6L)

Low-dimensional systems such as quantum wells, wires, and 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, Hetero- junctions and associated band-diagrams.

Text Book(s):

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.
(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 I

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.

Textbooks/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 II

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.

Textbooks/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 / 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.

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-to-neutral 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

Book

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

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 proven 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 Book :

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

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 for B.E. Semester III, Electrical Engineering

Course Code : MAT256 **Course : Electrical Engineering Mathematics**
L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Outcomes:
After studying the course, the students will be able to:

1. Understand Laplace transforms to solve engineering problems.
2. Understand the complex variables and its application.
3. Solve field problems in engineering involving PDEs.
4. Apply statistical method for analyzing experimental data and understand the basic importance of Numerical Methods to solve problems related to Engineering applications.

MODULE 1: [10Hours]
Laplace Transforms: Laplace transforms and their properties, Application for Laplace Transform to solve ordinary differential equations including simultaneous Differential Equations. Solution of one dimensional Partial differential equations by Laplace Transform method.

MODULE 2: [8Hours]
Functions of a Complex Variable: Function of a complex variable, Analytic functions, Cauchy-Riemann conditions, Conjugate functions, singularities, Cauchy's integral theorem and integral formula, Taylor's and Laurent's theorem, Residue theorem.

MODULE 3: [8Hours]
Partial Differential equations: 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.

MODULE 4: [8Hours]
Numerical Methods: Solution of algebraic and transcendental equations using method of false position and Newton-Raphson method. Solution of system of linear equations, Gauss elimination method, Gauss- Seidal method, .
Numerical solution of ordinary differential equations by Taylor's series method, Modified Euler's method, Runge-Kutta method.

MODULE 5: [8Hours]
Random Variable and Probability distribution: Expectation of Discrete Random Variables, Moments, Variance of Sum, Continuous random variables and their properties, Probability density function, probability distribution function for Discrete and continuous random variables, normal, exponential distribution.

Textbooks/References:

1. S.S.Sastry, Introductory methods of numerical analysis, PHI,4th Edition,2005.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : CET271 **Course : Engineering Mechanics & Strength of Materials**
L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

MODULE 1*:* [06 Hours]
Introduction to Engineering Mechanics: Force Systems, Basic concepts, System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra.

MODULE 2*:* [08 Hours]
Equilibrium & Friction: Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Virtual displacements, principle of virtual work for particle and system of rigid bodies, Analysis of truss using different methods. Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; simple lifting machines.

MODULE 3*:* [06 Hours]
Centroid and Moment of Inertia*:* Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

MODULE 4*:* [06 Hours]
Mechanical Vibration: Classification of vibration, damping and vibration, features of vibrating system, free vibration without damping, free vibration with damping, forced vibration without damping, forced vibration with damping, pendulum motion.

MODULE 5*:* [06 Hours]
Particle dynamics: Kinematics and Kinetics of particles, rectilinear motion, curvilinear motion, D'Alemberts principle and its application in connected system of particles, Impulse Momentum, Collision of bodies, Work Energy Method.

MODULE 6: [08 Hours]
Bending Moment & Shear Force: Transverse loading on beams, shear force and bending moment in beams, analysis of Cantilevers, simply supported beams and overhanging beams, relationships between loadings, shear force and bending moment, shear force and bending moment diagrams.
Torsional Motion: Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.

Text Books

1. Engineering Mechanics : F.L.Singer (Harper & Row Publication)
2. Fundamentals of Engineering Mechanics: A.K.Sharma, Sai Publication
3. Engineering Mechanics: Basudeb Bhattacharya,(Oxford University Press)
4. Strength of material : F.L.Singer , Harper & Row, New york
5. Strength of Materials : R. K.Rajput, S Chand

Reference Books

1. Engineering Mechanics: Timoshenko & Young, Tata McGraw Hill
2. Engineering Mechanics: Bear Johnston, Tata McGraw Hill
3. Engineering Mechanics: I.H.Shames, Phi Pvt. Ltd.
4. Mechanics of Materials "Beer,Johnston, Dewolf, Tata McGra Hill

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : EET251 **Course : Network Analysis**

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

Course Outcomes:

After the completion of the course, students will be able to:

CO1: Students can apply the basic Mathematical tools to circuit analysis.

CO2: Students can apply the frequency analysis to circuit with different input signals.

CO3: Students can find the useful characteristics of networks &three phase power.

CO4: Students can apply the graphical approach to networks.

Module-1 :Nodal And Mesh Basis Equilibrium Equations: [8 Hours]

Matrix approach for complicated network, containing voltage, current sources and reactances, source transformations, Solutions of Mutually coupled Networks, Duality.

Module-2: Network Theorems: [8 Hours]

Superposition, Reciprocity, Thevenin's, Norton's. Maximum Power Transfer, Compensation, Tellegen's theorem as applied to DC & A. C. circuits.

Module-3:Laplace Transform & Properties: [7 Hours]

Partial fractions, Evaluation of initial condition, Singularity functions, Waveforms synthesis, Steady state and transient state analysis of RL, RC, RLC network with and without initial conditions with Laplace transforms.

Module- 4: Network Functions & Sinusoidal Steady State Analysis:[7 Hours]

Transient behavior, Concept of complex frequency, Driving points and transfer functions, Poles, Zeros of admittance function, Their properties, Sinusoidal response from Pole- Zero locations, convolution integral solution. The Sinusoid &it's significance, Sine function with rotating phasor, phasor diagrams.

Module-5: Two Port Networks: [6 Hours]

Network parameters and inter-connections, Three phase unbalanced circuit and power calculations. Resonance in series & parallel RL, RC RLC circuits.

Module6-Network Graph Theory:[6 Hours]

Paths and Cycles, Connectivity, Trees, Spanning Subgraphs, Hamiltonian and Euler cycles. Matching theory. Planar graphs. Flows in networks, the max-flow min-cut theorem. Random graphs. Formation of incidence Matrix, Cut-set Matrix, Tie-set Matrix, Structural properties of large graphs

Text / References:

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.
4. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education,2004.
5. A.Chakrabarty, “Circuit Theory (Analysis & Synthesis)”, Dhanpat Rai & Co. 2006

References

1. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013.
2. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum's series, McGraw- Hill, New Delhi, 2010.
4. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi,2015.
5. Mahadevan, K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, “Introduction to Electric Circuits”, 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, McGraw Hill, 2015.

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : ENT259 **Course : Analog Electronic Circuits**
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

CO 1: Understand the operation and analyze the characteristics of semiconductor diodes, MOSFET, and BJT.
CO 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.
CO 3: 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.
CO 4: Understand the functioning of OP-AMP and design OP-AMP based circuits for linear and nonlinear applications.

MODULE 1: [04 Hours]
Diode Circuits: P-N junction diode, V-I characteristics of a diode; half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuit.

MODULE 2: [08 Hours]
BJT Circuits: Structure and V-I characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuit, high-frequency equivalent circuits.

MODULE 3: [08 Hours]
MOSFET Circuits: MOSFET structure and V-I characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuit - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

MODULE 4: [07 Hours]
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

MODULE 5: [07 Hours]
Operational amplifier: Ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, Gain bandwidth product) Op-amp circuits: Inverting and non-inverting amplifier, differential amplifier.

MODULE 6: [08 Hours]
Linear and Nonlinear applications of op-amp: Instrumentation amplifier, integrator, differentiator, active filter, oscillators (Wein bridge and phase shift). A/D, D/A Converters, Comparator, Square-wave and triangular-wave generators. Precision rectifier, Logarithmic amplifiers; Multivibrators

Textbook:
1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, "*Microelectronics Circuits: Theory and Applications*," Seventh Edition, Oxford University Press, 2017.
2. Sergio Franco,"*Design with Operational Amplifiers and Analog Integrated Circuits*," Fourth Edition, McGraw-Hill Education, 2014.

Reference books:
1. Donald Neamen, "*Electronic Circuits: Analysis and Design*," Third Edition, McGraw-Hill Publication, 2006.
2. Donald Neamen, "*Semiconductor Physics and Devices: Basic Principles*," Fourth edition, McGraw-Hill, 2011.
3. Jacob Millman, Christos Halkias, Chetan Parikh, "*Millman's Integrated Electronics*," Second edition, McGraw Hill Education, 2017.
4. J. V. Wait, L.P. Huelsman and G. A. Korn, Introduction to Operational Amplifier theory and applications, 2nd Edition, McGraw Hill, New York, 1992.
5. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : EET252 **Course : Electrical Measurements & Instrumentation**
L: 2 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Outcomes:
On completion of this course, the students will be able to
CO 1:Understand classification of different types of instrument and errors in it.
CO 2:Analyse and measure the resistance, Inductance, Capacitance & frequency by using bridges.
CO 3:Understand various types of analog and digital instruments and its application.
CO4: Understand the principle and construction of Special Instruments, Instrument Transformer for measurement of high voltage and current.
CO 5:Understand various transducer measurement of motion, pressure, flow and temperature.

Module -1: **[05 Hours]**
Philosophy Of Measurement:- Measurement System**,** classification of measuring Instruments, comparison of analog and digital instruments, absolute and secondary instruments, loading effect of instruments.

Module -2: **[08 Hours]**
Measurement of basic electrical elements:-Different methods of measuring low, medium and high resistances, Measurement of Inductance and Capacitance with the help of AC bridges, Potentiometers.

Module 3: [08 Hours]
Analog Measurement Techniques:- Ammeter, Voltmeter, Principles of moving coil, moving iron and dynamometer type instruments, extension of range using series and shunts. Measurement of power in single phase and three phase circuit by using dynamometer type instrument.

Module -4: **[08 Hours]**
Digital Measurement Techniques :- True RMS measurement, measurement of voltage, Current, power, frequency and energy. Oscilloscopes.

Module -5: **[05 Hours]**
Special Instruments and Instrument Transformer:- Megger, Ohm-meter, Earth tester, Extension of range using CT and PT, errors in instrument transformers, applications of instrument transformers.

Module -6 : [05 Hours]
Instrumentation :- Study of transducers for measurement of motion, pressure, flow and temperature.

Text books-

1. A Course in Electrical and Electronics Measurements and Instrumentation: 11ed., Sawhaney A. K., Dhanpat Rai & Sons, Delhi 1994.
2. Electrical Measurements and Measuring Instruments: 3ed., Golding, E. W., Widdis, F. C.,Wheeler's Student Edition, 1994.
3. Electrical Measurements and Instrumentation: U. A. Bakshi, A.V. Bakshi, Technical Publications,2009.
4. Electrical and Electronic Measurements and Instrumentation : R.K. Rajput.

Reference Book :

1. Electronic Measurements and Instrumentation: 3 ed., Cooper, W.D., Helfrick, A.D., Prentice-Hall of India,New Delhi 1991.

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : HUT251 **Course : Principles of Economics and Management**
L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Outcome:
CO1: Students will be acquainted with the basic concepts of Economics
CO2: Students will understand concepts that are the basis of the working of an economy.
CO3: Students will understand application of Economics in society and environment.
CO4: Students will understand the basics of management.
CO5: Students will be acquainted with the importance and application of Human Resource Management concepts
CO6: Students will learn about financial management and its areas of application.

MODULE 1: [7 Hours]
Micro Economics: Introduction to Economics: Definitions and scope, nature, methods, Central Economic Problems, Theory of Demand and Supply: Law of Demand and supply, its determinants, exceptions, and elasticity, Types of Market and industry equilibrium.

MODULE 2: [9 Hours]
Macro Economics: Different types of economy (Capitalist, Socialist, Mixed), Introduction to Indian Economy, National Income in India: Basic Concepts- GDP, GNP, NDP, NNP, FID, NFIA, per capita Income, Banks: Central Banks (Function and Credit control) Commercial Bank (Functions and credit creation), NBFSs, Inflation, Phrases of Business cycle, Taxation (Direct, Indirect/GST),

MODULE 3: [9 Hours]
Economic Sociology and Environmental Economics: Sociology of labour markets: Sociological approaches (Classical and Neoclassical theory) to labour markets; Social determinants of inequalities in wage and earning. Social cultural aspects of economic development: Impact of religion, caste, gender, ethnicity, family on economy. Environmental economics: Concept of sustainable development, methods of environmental evaluation: cost and benefit analysis, Hedonic pricing, willingness to pay (Consumer surplus).

MODULE 4: [6 Hours]
Introduction to Management: Definition of management, difference between management and administration, evolution of management, functions of management, functions of management: planning (PESTLE model), direction, controlling.

MODULE 5: [6 Hours]
Human Resource Management: The role of Human resources: Definition, Skill needed for HRM, today's HRM Challenges, Diversity and multiculturalism, recruitment and selection, training and development, compensation and benefits, managing employees' performance, employee assessment, work stress, safety and health

MODULE 6: [4 Hours]
Financial Management: Introduction to Financial Management: Definition, Objectives, Role of financial management in contemporary scenario, Financial Statements and tools: balance sheet, profit and loss account, budget, ratio analysis, depreciation.

Text Books

1. KK Dewett, *Modern Economic Theory*, (43rd Edition), S. Chand and Co. Ltd, New Delhi
2. P.C. Tripathi and P.N. Reddy "*Principles of Management*", Tata MacGraw Hill Publishing Co. Ltd. New Delhi
3. K. Aswathaptha "*Human Resource Management*" Tata MacGraw Hill Publishing Co. Ltd. , New Delhi
4. Ravi M. Kishore "*Financial Management*" Taxman Allied Services (P) Ltd., New Delhi
5. Fevre, Ralph. (1992), *The Sociology of Labour Markets*. Harvester Wheatsheaf, the University of California.
6. Rabindra N. Bhattacharya (2002) "*Environmental Economics: An Indian Perspective*", Oxford University Press
7. Karpagam M. (2012) "*Environmental Economics*", Sterling Publishers ltd

Reference books

1. M.L. Jhingan (2016) "*Micro Economics*", 8th Edition, 2016
2. M.L. Jhingan (2016) "*MacroEconomic Theory*", 13th Edition, 2016
3. K.K. Dewett and J.D. Varma "*Elementary Economic Theory",* S. Chand and Co, New Delhi
4. Rudradutt, K.P.M. Sundaram "*Indian Economy*", S. Chand and Co. Ltd
5. Martang. S. Telang "*Industrial and Business Management*", S. Chand and Co. Ltd, New Delhi
6. T. Ramaswamy, "*Principles of Management*" Himalaya Publishing House, Mumbai

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : CHT251 **Course : Environmental Science**

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

Course Outcomes

On successful completion of the course, the students:

1. Will get sufficient knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual'soutlook, so as to perceive our environmental issues correctly, using practical approach based on observations and self learning.
3. Will become conversant with recent waste management techniques such as E-wastes, its recycling and management.
4. Will gain knowledge about the modes for sustainable development, importance of green energy and processes.
5. Will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be adopted, to protect the environment from getting polluted.

Syllabus

Principle of contaminant behaviour and recent trends in environmental pollution control

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

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.

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

Introduction to noise pollution and its causes

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

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

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

IV-Water pollution and its control techniques: (8 lectures)

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

V- E-wastes (2 lectures)
Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

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

VII-Different government initiatives (2 lectures)
National ambient air quality standard 2009, Swacch bharat abhiyan, National afforestation program and Act-2016, National river conservation plan, Formation of National Green Tribunal

Books suggested:

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

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : ENT260 **Course : Digital Electronics and Microprocessor**
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
CO1: Design different combinational circuits for various applications.
CO2: Design various sequential circuits for different applications.
CO3: Design and verify digital systems using combinational and sequential circuits.
CO4: Understand the architecture of 8085 microprocessor and it's working.
CO5: Develop assembly language program using 8085 microprocessor instruction set.
CO6: Understand the concept of Subroutines and Interrupts in 8085 microprocessor.

MODULE 1: [06 Hours]
Logic Simplification: Binary/Hexa/octal/BCD Number system, Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, Logic Gates, SOP & POS forms, Logic Optimization Technique, Karnaugh maps. Introduction to logic families, TTL and CMOS logic, Tri-state logic, Memory- classification, organization, operation and interfacing.

MODULE 2: [06 Hours]
Combinational logic Design: Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Barrel Shifter, ALU.

MODULE 3: [09 Lectures]
Sequential Logic Design Latches, Flip flop – S-R, J-K, D, T and Master-Slave JK FF, counters, Shift registers.

MODULE 4: [06 Hours]
Microprocessor Introduction: Introduction of Intel's 8085A: Architecture, description. Flag structure, concept of PSW, Addressing modes, Timing diagrams,

MODULE 5: [09 Hours]
Programming: Instruction Set Stack and Subroutine, Simple and Nested subroutines, Push-Pop, Call-Return instructions, Stack manipulation, (simple programming)..

MODULE 6: [06 Hours]
Interrupts: Interrupt concept& structure in 8085, Interrupt Service Routines (ISR), advanced instructions of Programming of 8085A.

Text books :-

1. Digital Electronic Principles, By Malvino PHI, 3rd Edition.
2. Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009.
3. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar, 5th Edition, Penram International Publications.

Reference books :-

1. Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.
2. Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016.

Syllabus for B.E. Semester III, Electrical Engineering

Course Code : EET271 | **Course : Signals and Systems**
L: 2 Hrs., T: 1 Hrs., P: 0 Hrs., Per week | **Total Credits : 03**

Course Outcomes:

At the end of this course, students will demonstrate the ability to
CO1: Understand the different types of signals and systems.
CO2: Understand the concepts of continuous time and discrete time systems.
CO3: Analyze systems in complex frequency domain.
CO4: Understand sampling theorem and its implications.

Module 1: Introduction to Signals and Systems (7 hours):
Signals and systems as seen in everyday life, and in various branches of engineering and science. Different types and properties of signal and systems. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals.

Module 2: Behavior of continuous and discrete-time LTI systems (7 hours)
Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response

Module 3: Fourier Transform (5 hours)
Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT), the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT). Parseval's Theorem.

Module 4: Laplace Transform (5 hours)
Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior.

Module 5: z- Transform (5 hours)
The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Module 6: Sampling and Reconstruction (6 hours)
The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
3. H. P. Hsu, “Signals and systems”, Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.*AICTE Model Curriculum for Undergraduate degree in Electrical Engineering (Engineering & Technology)*
5. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
6. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
7. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

Syllabus for B.E. Semester IV, Electrical Engineering

Course Code : EET272 | **Course : Electrical Machines-I**
L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week | **Total Credits : 04**

Course Outcomes

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

CO1: Basic principles, constructional features, electric and magnetic circuits of various electrical machines.

CO2: Construction and operation characteristics of DC motor and DC generator.

CO3: Constructional features and operation of single phase and three phase transformer and determine equivalent circuit parameters, efficiency and regulation at different loads.

CO4: Various transformer connection, phasor groups, parallel operation and concept of daily load cycle to calculate all day efficiency.

CO5: Construction operation and characteristics of three phase induction motors, and its testing to calculate equivalent circuit parameters.

CO6: Starting, speed control and power stages of three phase induction motor and construction and principal of single phase induction motors.

MODULE 1:

Basic Concepts and Magnetic Circuit (08 Hours)

MMF and reluctance, Faraday's Law, Dynamically and statically induced EMF, Self, mutual and leakage inductance, Electric and magnetic circuits for various electrical machines (Cores and windings). B-H Curve, Magnetic losses and it's dependence on voltage and frequency.

MODULE 2:

D. C. Machines (08 Hours)

Basic principle & operation of DC generators and DC motors (separately excited, shunt and series), Induced emf equation, Characteristics of DC generators and DC motors, speed control of DC motors, Losses & Efficiency.

MODULE 3:

1 Phase & 3 Phase Transformer : Construction & Pricniple (08 Hours)

Transformer operation and principle, phasor, equations and phasor diagrams at different p.f. O.C. & S.C. test, determination of equivalent circuit parameters, regulation, efficiency, Auto transformer, Concept of Inrush current.

MODULE 4:

1 Phase & 3 Phase Transformer : Operation & Testing (08 Hours)

Daily Load Cycle and All day efficiency of transformer, Polarity test, various connections with vector groups, Three phase to two phase conversion (qualitative analysis), parallel operation of transformer, methods of cooling, temperature rise test. Tap changer (on load and off load).

MODULE 5:

Three Phase Induction Motor: Construction and Principle (08 Hours)

Types of induction motor and production of torque, Torque-slip characteristics (Induction Motor and Generator), No load blocked rotor test, equivalent circuit & determination of equivalent circuit parameters, losses, efficiency.

MODULE 6: Operation of Single phase and Three Phase Induction Motor (08 Hours)

Power stages of induction motor, losses and efficiency, Load characteristics of induction motor, Starting and Speed control of induction motor. Double cage motors, Single phase induction motor (Split phase and shaded pole).A. C. Series motor.

TEXT BOOKS:

1. Electrical Machines: Dr. P.S. Bimbhra
2. Electrical Machines: Ashfaq Hussain
3. A Text Book of Electrical Technology: B. L. Theraja (Vol. II)

REFERENCE BOOKS:

1. Performance & Design of A.C. Machine: M. G. Say
2. Electrical Machines: I.S. Nagrath& Dr. D.P. Kothari
3. Laboratory Courses in Electrical Engineering: Tarnekar, Kharbanda, Bodkhe & Naik

Syllabus for B.E. Semester IV, Electrical Engineering

Course Code : EET273 **Course : Programming for EE Application**
L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Outcomes:

On completion of the course students should be able to:

CO1 : Develop programs on building of Functions, Arrays, Pointers and Structure for solving engineering problems
CO2: Design programs using a variety of data structures such as stacks, queues, hash tables, binary trees and implement sorting and searching algorithm.
CO3: Understand and apply the features of object oriented programming concepts.
CO4: Apply the concept of operator overloading, inheritance and polymorphism in problem solving.
CO5: Execute programs using basic features of Python language and work with external Python libraries.

MODULE 1: Applications of C Concepts [06 Hours] : Review of Pointers and Arrays in C, Pointers to Function, Pointers to Structures, accessing members of structures using structure variables, passing structures to functions. Structures as user defined data types, File handling. Programs based on solving on Engineering problems

MODULE 2: Data Structures in C [08 Hours] : Introduction to Data Structures: Basic Concepts of Data, Types of Data Structures, Arrays: Ordered Lists, Sparse Matrices, Quick Sort, Merge Sort, Heap Sort, selection & Bubble Sort, Linear Search, Binary Search. Programs based on solving Engineering problems

MODULE 3: Data Structure Applications [06 Hours]: Definition and applications of Stacks, Queues, Linked Lists and Trees. Introduction to Hashing tables.

MODULE 4: Introduction to Object Oriented Programming (C++) [06 Hours] : Concept of object, class, objects as variables of class data type, difference in structures and class in terms of access to members, private and public. Structure of C++ programs, introduction to defining member functions within and outside a class, declaring class, creating objects, constructors & destructor functions. Members of a class, data & function members

MODULE 5: Object Oriented Programming Applications [08 Hours]: Operator Overloading: Fundamentals, Restrictions, operator functions as class members v/s as friend functions. Inheritance: Base classes and derived classes, protected members, relationship between base class and derived classes, constructors and destructors in derived classes, public, private and protected inheritance Polymorphism: concept, relationship among objects in inheritance hierarchy, abstract classes, polymorphism. Programs based on solving Engineering problems.

MODULE 6: Introduction To Python Programming [08 Hours] : Types, Values, Expressions using if, else and while. Implementing functions, lists, tuples and dictionaries. Import and use of Python libraries like Numpy and Matplotlib for developing applications.

Text Books

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
2. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
3. Programming in C++ : E. Balguruswami
4. Python essential reference, 3rd Edition -david M. Beazley

Reference books-

1. "Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
2. Think Python, 2nd Edition - How to Think like a Computer Scientist Allen B. Downey

Syllabus for B.E., Semester IV (Open Electives)

Course Code : EET299-1 **Course : Consumer Electrical Appliances**
L: 3 Hrs., T: 3 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Outcomes :
Upon completion of this course, students will be able to.
CO1: Understand concept of Energy Efficiency of Electrical appliances & types of power supply unit used in these appliances.
CO2: Understand the different electrical power supply backup equipments like battery, Inverter, UPS, & photovoltaic system.
CO3: Understand working principle & application of different electrical motors.
CO4: Understand working principle of appliances used for heating & cooling purpose.
CO5: Understand construction & working principle of electrical domestic appliances.
CO6: Test & perform maintenance of Consumer Electrical Appliances.

MODULE 1: [06 Hours]
Basics of DC & AC systems, voltage-current-power relationships, AC DC sources for appliances, Star rating, Energy efficiency in Electrical appliances, Importance of IS codes, IE codes

MODULE 2: [08 Hours]
Introduction to AC/DC Motors for Appliances (FHP Motors) - Single Phase Motors (FHP), DC Motors, BLDC Motors, Universal Motors.

MODULE 3: [08 Hours]
HVAC Appliances-: Construction, Working Principle, Ratings/Specifications, Control of
a) Resistance heating: Water heaters, Room Heater, Tea/ Coffee Maker, Oven, Toasters, Iron
b) Non Resistive heating: Induction heaters, Microwave oven
c) Cooling Appliances: Construction, Working Principle, Ratings/Specifications, Control of Fans, Desert Coolers, Air conditioner, Refrigerator

MODULE 4: 08 Hours]
Power supply Equipment: Battery and battery chargers, Switch mode power supply, Inverter, Uninterrupted Power Supply (UPS), Photovoltaic power System

MODULE 5: [06Hours]
Other Consumer appliances: Construction, Working Principle, Ratings/Specifications, Control Mixer, Grinder, Juicer, Vacuum Cleaner, Air Purifier, Washing Machines, Weighing scale, Elevator

MODULE 6: [06 Hours]
Illumination-Construction, Working Principle, Ratings/Specifications, Control of LED Lights.

Text Book/ Resources:
1) Consumer Electronics by S P Bali, Pearson
2) Handbook of Repair & Maintenance of domestic electronics appliances: BPB Publications
3) Literature available through e-resources

Syllabus for B.E., Semester IV (Open Electives)

Course Code : EET299-2 **Course : Renewable Energy Sources**
L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Outcomes:
Understanding of renewable energy sources
Knowledge of working principle of various energy systems
Capability to carry out basic design of renewable energy systems

MODULE-I : (05 Hrs)
Global and National Energy Scenario: Over view of conventional & renewable energy sources, need, potential &development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Energy for sustainable development, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems.

MODULE–II: (10 Hrs)
Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Solar-Electrical Power Generation, general Solar Photo Voltaic (SVP) system, Different configurations, SPV system components and their characteristics, Stand-Alone and Grid Connected SPV systems, other Miscellaneous Applications of Solar Energy.

MODULE–III: (06 Hrs)
Wind Energy: Wind Energy Conversion, Potential, Nature of the wind, Wind Data and Energy Estimation, Site selection, Types of wind turbines, Wind farms, Wind Generation and Control., classification of wind, characteristics, offshore wind energy – Hybrid systems, wind energy potential and installation in India.

MODULE -IV: (06 Hrs)
Hydel and Tidal Power Systems: Basic working principle, Classification of hydel systems: Large, small, micro – measurement of head and flow – Energy equation – Types of turbines – Numerical problems. Tidal power – Basics – Kinetic energy equation – Numerical problems – Wave power – Basics – Kinetic energy equation.

MODULE- V: (06 Hrs)
Bio-Mass,Geothermal& Ocean Energy: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.
Geothermal Energy**:** Resources, types of wells, methods of harnessing the energy, potential in India. Ocean Energy**:**OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

MODULE- VI: (05 Hrs)

Integrated Energy Systems: Introduction, Integrated Smart infrastructure, Integrated Energy system Modeling, Various Integrated energy schemes, their cost benefit analysis,.

Text Books

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition.
2. Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition, 2013.
3. Non-Conventional Energy Sources /G.D. Rai, Khanna Publishers

Reference Books

1. Renewable Energy- Edited by Godfrey Boyle-oxford university, press, 3rd edition, 2013.
2. Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore.
3. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
4. Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI.
5. Non conventional energy source –B.H. Khan- TMH-2nd edition.
6. Integrated energy systems modeling–Karlsson, Kenneth Bernard; Skytte, Klaus Morthorst; Published in: DTU International Energy Report 2015.

Syllabus for B.E. Semester IV, Electrical Engineering

Course Code : EET275 **Course : Electromagnetic Fields**

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

Course Outcomes

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

CO 1: Understand vector analysis, vector and scalars conversion for different coordinate system like conversion of Cartesian to Cylindrical, Spherical coordinate system and vice versa

CO 2: Understand scalar and vector magnetic and electric field and how to calculate force on steady and moving charge.

CO 3: Apply Coulomb's law, Gauss law, Divergence theorem to electric field intensity i.e. field of 'n' point charges, volume charge, line charge etc.

CO 4: Find potential difference and potential of point charge.

CO 5: Apply effective analysis tool like Poisson's and Laplace equations to current, current density, dielectrics and capacitances, metallic conductors.

CO 6: Understand the nature of dielectric materials like in parallel plate capacitance, two wire line capacitance.

CO 7: Understand steady magnetic field and magnetic forces, also nature of magnetic material. Also how to apply BiotSavorts law, Ampere's circuital law and Stroke theorem to magnetic circuit.

CO 8: Understand the role of Maxwell's equation and boundary conditions.

CO 9: Understand basics of electromagnetic waves.

MODULE 1: [06Hours]

Vector Analysis: Idea of Vector & Scalars, Vector Algebra, Vector addition, vector subtraction, Dot product, Scalar product in Cartesian coordinate system, conversion of variables from Cartesian to cylindrical of Cartesian to spherical and vice versa.

MODULE 2: [06Hours]

Coulomb's law, Electrical field intensity and electric flux density: Coulomb's law, electric field intensity, field often, point charges, field due to continuous volume charge distribution, field of line charge, field of sheet charges concept of flux density.

MODULE 3: [08 Hours]

Gauss's law, Energy and Potential of charge system: Gauss's law, Application of Gauss's law, divergence theorem, definition of potential difference and potential, potential of a point charges, potential field of system of charge, potential gradient, Energy density in Electrostatic field.

MODULE 4: [10 Hours]

Conductors, Dielectric and Capacitance and Poisson's and Laplace's Equations: Current and current density, continuity of current, metallic conductors, conductor properties and Boundary conditions, Nature of Dielectric materials capacitance and capacitances, Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons and Laplace equations.

MODULE 5: [10Hours]

The Steady Magnetic Field and Magnetic Forces: Biot Savarts law, Ampere's Circuital Law, Strokes theorem, Magnetic flux density, Scalar and Vector Magnetic potentials, force on moving charge, force between differential current elements, nature of Magnetically material, Magnetization and permeability, Magnetic circuits, potential energy, and forces on magnetic materials, Inductance and mutual inductances.

MODULE 6: [02 Hours]

Maxwell's equations and boundary conditions, Elementary idea of Electromagnetic waves,

Text Books:

Engineering Electromagnetic:3rd Ed., Mc-Graw Hill, W. H. Hayt

Reference Books:

Electromagnetic, Joseph A. Administer

Syllabus for B.E. Semester IV, Electrical Engineering

Course Code : HUT252 **Course : Indian Traditional Knowledge**

L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 00**

Course outcome:

Students will have increased ability to understand the importance and application of:

CO1: Indian Knowledge system and its scientific approach

CO2: Indian philosophical tradition

CO3: Indian artistic tradition

CO4: Traditional knowledge and protection of nature

CO5: The legality and its importance for the protection of Indian traditional knowledge

MODULE 1: [07 Hours]

Basic Structure of Indian Traditional Knowledge: *Vedas, Upavedas, Vedang, Upadang,* scientific approach

MODULE 2: [05 Hours]

Ecology and Indian Traditional Knowledge: Meaning, role, case studies

MODULE 3: [07 Hours]

Intellectual Property Rights and Indian traditional Knowledge: Meaning, role in protection of Indian traditional knowledge, cases studies

MODULE 4: [07 Hours]

Indian Philosophical traditions: *Nyay, Sankaya, Yog, Mimansa,* Jainism, Buddhism, Sikhism, and other approaches

MODULE 5: [04 Hours]

Indian Artistic Traditions: *Chitrakala, Murtikala, Vastukala, Sangeet, Sthpatya, NrityaevamSahitya,* case studies

Reference Material

1. RR Gaur, Rajeev Sangal, GP Bagaria, *Human Values and Professional Ethics* (Excel Books, New Delhi, 2010)
2. V. Sivaramakrishanan (ed.), *Cultural Heritage of India – Course material,* BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014
3. Swami Jitatmanand, *Modern Physics and Vedant,* BharatiyaVidyaBhavan
4. Swami Jitatmanand, *Holistic Science and Vedant,* BharatiyaVidyaBhavan
5. S.C. Chatterjee and D.M. Datta, *An introduction to Indian Philosophy,* University of Calcutta, 1984
6. Pramod Chandra, *Indian Arts,* Howard University Press, 1984
7. Krishna Chaitanya, *Arts of India,* Abhinav Publications, 1987.

Syllabus for B.E. (Minor Specialization)

Course Code : EETM41 **Course : Electrical Machine**

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

Course Outcomes

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

CO1: Basic principles, constructional features, electric and magnetic circuits of various electrical machines.

CO2: Construction and operation characteristics of DC motor and DC generator.

CO3:. Construction and operation characteristics of Three phase AC Generator

CO4: Constructional features and operation of single phase and three phase transformer and determine efficiency and regulation at different loads.

CO5: Construction operation and characteristics of three phase induction motors, and its testing to calculate equivalent circuit parameters.

CO6: Starting, speed control and power stages of three phase induction motor and construction and principal of single phase induction motors.

MODULE 1 :- Basic concepts of electricity and magnetism

Ohm's Law, Kirchhoff's laws for DC & AC circuit, Magnetic circuit, MMF and flux, faraday's law, Concept of EMF, MMF, Power and Power Factor.

MODULE 2 :- DC Generator & DC Motor

Electro-mechanical and electro-magnetic energy conversion, Basic construction and principle of working for DC (separately excited & shunt) motor & generator, concept of losses & efficiency. Motor & Generator characteristics, Speed control & starting of DC motor.

MODULE 3 :- 3- Phase AC generator

Concept of balanced 3 phase voltage and current, Volt-Ampere , Active & Reactive Power, Construction & Principle of working for 3 phase AC (Synchronous Generator), Induced EMF equation & Synchronous speed & frequency. Phase & Line values of Voltage & Current, Balanced 3 phase loads on 3 phase AC generator, Voltage Regulation of ac generator.

MODULE 4:- Transformer

Necessity of step up & step down transformer in power system, Faraday's law of Electromagnetic Induction, Statically & Mutually induced EMF, Construction & Operation of Transformer, Transformation Ratio, KVA Rating for 3 phase Transformer, Losses and Efficiency, Voltage Regulation.

MODULE 5:- 3 Phase Induction Motor

Construction and Principle of working of 3 phase Induction Motor, Revolving Magnetic Field theory, Concept of synchronous speed and slip, Types of Induction motor, Losses and efficiency, Motor Characteristic, Speed control and starting of Induction motor.

MODULE 6 :- Single phase Induction motor

Single phase induction motor, Split Phase type, Construction & working of motor, applications , motors for domestic and industrial applications.

Text Books:

1. Electrical Machines: Dr. P. S. Bimbhra
2. Electrical Machines: Ashfaq Hussain
3. A Text Book of Electrical Technology: B. L. Theraja (Vol. II)

Reference Books:

1. Performance & Design of A.C. Machine: M. G. Say
2. Electrical Machines: I. S. Nagrath& Dr. D. P. Kothari
3. Laboratory Courses in Electrical Engineering: Tarnekar, Kharbanda, Bodkhe & Naik

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