SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR - 440 013

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

PROGRAMME SCHEME & SYLLABI
2019 - 2020

B. E. (ELECTRONICS AND COMMUNICATION ENGINEERING)

Published by
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ISO 9001 : 2015 CERTIFIED ORGANISATION

About the Department:

The Department was established in the year 2001and has been accredited by National Board of Accreditation in the year 2008 for three years and in 2014 for two years.

The department has Well-equipped laboratories with advanced equipments worth more than Rs. 1 crore along with advanced softwares. MODROB proposal of Rs.15 Lacs was sanctioned by AICTE for the year 2011-12 for the "Up-gradation of Digital Communication Networking facilities in the field of Communication Engineering".

A forum called 'Communique' has been set up by the department which provides a platform to the students and staff to showcase their talent through various technical, curricular and co-curricular activities.

Salient Features of The Department:

1. The department is the first choice of the students in Central India.
2. Highest placement amongst private institutes in the region.
3. Excellent academic results with many university rankers/ highest CGPA.
4. Students have undergone Academic/Industry training in foreign Universities.
5. Students excel in Professional Examinations.
6. Students outshine in various sports activities of University / State level.
7. Alumni have achieved higher position in Multi-National Companies.
8. Students and the faculty from the Department honoured as "Best Student" and "Best Teacher" by RTM Nagpur University.
9. State-of-Art infrastructure.
10. Young, enthusiastic & dedicated staff with research aptitude.
    - No of Ph.D.s : 09
    - Ph.D. (Pursuing) : 05
11. Faculty members have to their credit around 175 research publications.
12. Department has research projects with IIT Bombay, under Government of India's NUP program and FOSSEE project.
13. Patent has been published on "Remote Monitoring of Energy Meter using Telephone Lines".

Department Vision :

To establish the department as a center of excellence in academics and research with advances in the rapidly changing field of Electronics and Communication

Department Mission:

To create stimulating environment for learning and imparting quality technical education to fulfill the needs of industry and society

Programme Educational Objectives

The programme aims to:

1. Create graduates with basic knowledge of sciences, mathematics and technical expertise with ability to excel in professional career and/or higher education.
2. Develop competent and self motivated professionals with ethical responsibilities.
3. Develop engineers with capability to apply knowledge and evaluate results based on facts, tests, experimentations and research.
4. Inculcate multidisciplinary skills along with leadership and managerial qualities for life-long learning and development.

Programme Outcomes

After successful completion of program students will attain:

1. Ability to apply the knowledge of mathematics, science and engineering fundamentals, to solve the engineering problems.
2. Ability to Identify, formulate, and analyze engineering problems using principles of mathematics and engineering sciences.
3. Ability to develop solutions for complex engineering problems and design system components or processes to meet the needs of the society.
4. Ability to use engineering knowledge to design experiments, analyze, interpret data, and synthesize the information to provide valid conclusions.
5. Ability to create, select, and apply appropriate techniques, resources, and modern engineering and simulation tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. Ability to assess and analyze the impact of engineering practices on societal issues.
7. Ability to assess and analyze the impact of engineering practices on environmental issues.
8. Ability to apply ethical principles and commit to professional ethics and responsibilities in engineering practices.
9. Ability to function effectively as an individual or as a leader in diverse teams, and in multidisciplinary field.
10. Ability to communicate effectively, write precise reports, design documentation, make effective presentations for engineering activities
11. Ability to analyze financial aspects involved in Engineering projects with managerial skills
12. Ability to prepare and engage in independent and life-long learning in the context of technological change.

Program Specific Outcomes

The Graduates of Electronics & Communication will be able to

1. Understand basic concepts of Electronics & Communication Engineering & apply them to design functional blocks of analog & digital systems.
2. Implement effective & appropriate systems in the field of signal processing and communication aplications.

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	Hours/week T	Hours/week P	Credits	Maximum Marks: Continual Assessment	Maximum Marks: End Sem Examination	Maximum Marks: Total	ESE Duration (Hours)
1.	CHT151	Chemistry	All Branches	3	1	0	4	40	60	100	03
2.	CHP151	Chemistry Lab	All Branches	0	0	3	1.5	25	25	50	–
3.	MAT151/ MAT152	Calculus / Differential Equations, Linear Algebra, Statistics & Probability	All Branches	3	1/0	0	4/3	40	60	100	03
4.	CST151	Programming for Problem Solving	All Branches	4	0	0	4	40	60	100	03
5.	CSP151	Programming for Problem Solving Lab	All Branches	0	0	2	1	25	25	50	–
6.	IDT151	Creativity, Innovation & Design Thinking	All Branches	1	0	0	1	20	30	50	1.5
7.	INT151	Workshop/Manufacturing Practices Lab	All Branches	1	0	0	1	20	30	50	1.5
8.	INP151	Workshop/Manufacturing Practices Lab	All Branches	0	0	2	1	25	25	50	–
9.	HUT151	English	All Branches	2	0	0	2	40	60	100	03
10.	HUP151	English Lab	All Branches	0	0	2	1	25	25	50	–
			Total	14	2/1	9	**20.5/19.5**			**700**	

Scheme of Teaching & Examination of Bachelor of Engineering
III Semester B.E. (Electronics & Communication 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	ECT 251	Electronic Devices	3	1	0	4	40	60	100	3
2	ECP 251	Electronics Devices Lab	0	0	2	1	25	25	50	3
3	ECT 252	Digital System Design	3	0	0	3	40	60	100	3
4	ECP 252	Digital System Design Lab	0	0	2	1	25	25	50	3
5	ECT 253	Signals and Systems	3	1	0	4	40	60	100	3
6	ECT 254	Network Theory	3	0	0	3	40	60	100	3
7	ECP 255	Electronic Measurement Lab	0	0	2	1	25	25	50	3
8	MAT255	Engineering Mathematics	3	0	0	3	40	60	100	3
9	HUT256	Indian Traditional Knowledge	2	0	0	0	–	–	–	–
		TOTAL	**17**	**2**	**6**	**20**				

Scheme of Teaching & Examination of Bachelor of Engineering
IV Semester B.E. (Electronics & Communication 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	ECT 256	Analog and Digital Communication	3	0	0	3	40	60	100	3
2	ECP 256	Analog and Digital Communication Lab	0	0	2	1	25	25	50	3
3	ECT 257	Analog Circuits	3	0	0	3	40	60	100	3
4	ECP 257	Analog Circuits Lab	0	0	2	1	25	25	50	3
5	ECT 258	Microprocessors	3	0	0	3	40	60	100	3
6	ECP 258	Microprocessors Lab	0	0	2	1	25	25	50	3
7	ECT 259	Probability Theory and Stochastic Processes	3	1	0	4	40	60	100	3
8	PHT251	Introduction to Electromagnetic Theory	3	0	0	3	40	60	100	3
9	ECT299	**Open Elective - I**	3	0	0	3	40	60	100	3
10	CHT252	Environmental Science	2	0	0	0	–	–	–	–
		TOTAL	**20**	**1**	**6**	**22**				

Scheme of Teaching & Examination of Bachelor of Engineering
V Semester B.E. (Electronics & Communication 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	ECT 351	Electromagnetic Waves	3	0	0	3	40	60	100	3
2	ECP 351	Electromagnetic Waves Lab	0	0	2	1	25	25	50	3
3	ECT 352	Control Systems	3	0	0	3	40	60	100	3
4	ECT 353	Microcontrollers & Interfacing	3	0	0	3	40	60	100	3
5	ECP 353	Microcontrollers & Interfacing Lab	0	0	2	1	25	25	50	3
6	ECT 354	Digital Signal Processing	3	1	0	4	40	60	100	3
7	ECP 354	Digital Signal Processing Lab	0	0	2	1	25	25	50	3
8	ECT 355	Program Elective - 1	3	0	0	3	40	60	100	3
9	ECT 398	**Open Elective - 2**	3	0	0	3	40	60	100	3
10	HUP357	Personality Development	0	0	2	1	25	25	50	3
TOTAL			**18**	**1**	**8**	**23**				

Scheme of Teaching & Examination of Bachelor of Engineering
VI Semester B.E. (Electronics & Communication 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	ECT 357	Computer Architecture	3	0	0	3	40	60	100	3
2	ECT 358	Computer Network	3	0	0	3	40	60	100	3
3	ECP 358	Computer Networks Lab	0	0	2	1	25	25	50	3
4	CST 364	Object Oriented Data Structure	2	0	0	2	40	60	100	3
5	CSP 364	Object Oriented Data Structure Lab	0	0	2	1	25	25	50	3
6	ECP 359	Mini Project / Electronics Design workshop	0	0	4	2	25	25	50	3
7	ECT 360	Program Elective - 2	3	0	0	3	40	60	100	3
8	ECT 399	**Open Elective - 3**	3	0	0	3	40	60	100	3
9	IDT 353	Biology for Engineers	3	0	0	3	40	60	100	3
10	ECP 361	Comprehensive Viva	0	0	2	1	25	25	50	3
	TOTAL		**17**	**0**	**10**	**22**				

List of Program Elective Courses (PEC) for V and VI Semesters

Sr. No.	Course Code	Course Title	Preferred Semester
1.	ECT 355 - 1	Information Theory and Coding	V
2.	ECT 355 - 2	CMOS Design	V
3.	ECT 355 - 3	Power Electronics	V
4.	ECT 355 - 4	Scientific computing	V
1.	ECT 360 - 1	Speech and Audio Processing	VI
2.	ECT 360 - 2	Introduction to MEMS	VI
3.	ECT 360 - 3	Bio-Medical Electronics	VI
4.	ECT 360 - 4	Nano electronics	VI

Scheme of Teaching & Examination of Bachelor of Engineering
VII Semester B.E. (Electronics & Communication 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	ECT451	Program Elective - 3	3	0	0	3	40	60	100	3
2	ECT452	Program Elective - 4	3	0	0	3	40	60	100	3
3	ECT453	Program Elective - 5	3	0	0	3	40	60	100	3
4	HUT498-1	**Open Elective - 4**	3	0	0	3	40	60	100	3
5	HUT452	Engineering Economics	3	0	0	3	40	60	100	3
6	ECP 454	Industry Internship Evaluation (6-8 weeks)	0	0	2	0	--	--	--	--
7	ECP 455	Project Stage - I	0	0	10	5	50	50	100	3
		TOTAL	**15**	**0**	**12**	**20**				

Scheme of Teaching & Examination of Bachelor of Engineering
VIII Semester B.E. (Electronics & Communication 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	ECT456	Program Elective - 6	3	0	0	3	40	60	100	3
2	ECT457	Program Elective - 7	3	0	0	3	40	60	100	3
3	ECP458	Project Stage-II / 1 One Semester Industry Project / Incubation	0	0	18	9	50	50	100	3
		TOTAL	**6**	**0**	**18**	**15**				

List of Program Elective Courses (PCE) for VII and VIII Semesters

Sr. No.	Course Code	Course Title	Preferred Semester
1.	ECT 451-1	Microwave Theory and Techniques	VII
2.	ECT 451-2	Adaptive Signal Processing	VII
3.	ECT 452-1	Antennas and Propagation	VII
4.	ECT 452-2	Digital Image & Video Processing	VII
5.	ECT 452-3	High Speed Electronics	VII
6.	ECT 453-1	Wireless Sensor Networks	VII
7.	ECT 453-2	Mixed Signal design	VII
8.	ECT 453-3	Embedded Systems	VII
1.	ECT 456-1	Error correcting codes	VIII
2.	ECT 456-2	Fiber Optic Communications	VIII
3.	ECT 457-1	Satellite Communication	VIII
4.	ECT 457-2	Mobile Communication and Networks	VIII
5.	ECT 457-3	Wavelets	VIII

List of Open Electives

Sr. No.	Semester	Course Code	Courses
1.	IV	ECT 299	ECT 299-1 : Renewable Energy
			ECT 299-2 : Evolution in communication Technologies
2.	V	ECT 398	ECT 398-1 : Engineering for Agriculture
			ECT 398-2 : Sensors and Transducers
3.	VI	ECT 399	ECT 399-1 : Python Programming for Machine Learning
			ECT 399-2 : Rural Technology
4.	VII	HUT 498-1	HUT 498-1: Technical Communication

Scheme of Teaching & Examination of Bachelor of Engineering
Honors Specialization (Electronics & Communication 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	ECTH41	Communication System Analysis	4	0	0	4	40	60	100	3
2	ECTH51	Radio Frequency Circuit Design	4	0	0	4	40	60	100	3
3	ECTH61–1	Wireless Channel	4	0	0	4	40	60	100	3
	ECTH61–2	Broadband Communication								
4	ECTH71–1	Smart Antennas	4	0	0	4	40	60	100	3
	ECTH71–2	Cryptography and Inform- - ation Security								
5	ECTH81–1	Evolution of Air Interface towards 5G	4	0	0	4	40	60	100	3
	ECTH81–2	Artificial Intelligence and Machine Learning								

Scheme of Teaching & Examination of Bachelor of Engineering
Minors Specialization (Electronics & Communication 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	ECTM41-1	Electromagnetic Fields	4	0	0	4	40	60	100	3
2	ECTM41-2	Analog and Digital Communication	4	0	0	4	40	60	100	3
3	ECTM51-1	Electromagnetic Waves	4	0	0	4	40	60	100	3
	ECTM51-2	Digital Signal Processing								
4	ECTM61-1	Antennas	4	0	0	4	40	60	100	3
	ECTM61-2	Computer Communication Networks								
5	ECTM71-1	Microwave Engineering Evaluation (6-8 weeks)	4	0	0	4	40	60	100	3
	ECTM71-2	Wireless Sensor Network								
6	ECTM81-1	Satellite Communication	4	0	0	4	40	60	100	3
	ECTM81-2	Mobile Communication								

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

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

Course Objectives:

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

Course Outcomes:

After successful completion of the course students will

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

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

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

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

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

Module 3: Conservative Forces (5L)

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

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

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

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

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 BE I / II

Bachelor of Mechanical Engineering, Electrical Engineering

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

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

Course Objectives:

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

Course Outcomes:

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

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

Module 1: Oscillations (8L)

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

Module 2: Waves - 1 (5L)

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

Module 3: Waves - 2 (5L)

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

Module 4: Wave Optics - 1 (6L)

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

Module 5: Wave Optics - 2 (6L)

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

Module 6: Matter Waves (8L)

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

Text Book(s):

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

References:

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

Syllabus for Semester I / II

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

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

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

Course Objectives:

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

Course Outcomes:

After successful completion of the course students will

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

Module 1: Quantum Mechanics Introduction (6L)

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

Module 2: Electronic Materials (8L)

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

Module 3: Intrinsic and Extrinsic Semiconductors (10L)

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

Module 4: Junction Physics (8L)

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

Module 5: Light - Semiconductors Interaction (6L)

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

Module 6: Engineered Semiconductor Materials (6L)

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

Text Book(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. (2018-19)
(Semester I: Electronics, Electronics Design Technology, Electronics & Communication Engineering)
(Semester II: Computer Science Engineering and Information Technology)

Course Code : PHP153 **Course : Semiconductor Physics Lab**
L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

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

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

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

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

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

Syllabus for B.E. Semester 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.

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

List of Laboratory Experiments/Demonstrations:

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

Syllabus of Department of Mechanical Engineering

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

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

Course Outcomes

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

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

UNIT 1 : Introduction to Engineering Drawing

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

UNIT 2 : Orthographic Projections

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

UNIT 3 : Projections of Solids

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

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid Cone-Auxiliary Views; Development of surface of Right Regular solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

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

Suggested Text / Reference Books :

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

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

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

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

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

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

Syllabus of Department of Mechanical Engineering

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

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

Course Outcomes

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

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

UNIT 1 : Introduction to Engineering Drawing

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

UNIT 2 : Orthographic Projections

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

UNIT 3 : Projections of Solids

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

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism Cylinder, Pyramid, Cone - Auxilary Views; Development of surfaces of Right Regular Solids Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

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

UNIT 6 : Overview of Computer Graphics

Demonstrating knowledge of the theory of CAD software such as (the Menu System Toolbars Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, crosshairs, Coordinate Systems), Dialog boxes and windows, Shortcut menus (Button Bars), The command Line (wherever applicable), The Status Bar, Different methods of zoom as used in CAD, select and erase objects; Isometric Views of lines, Planes, Simple and compound solids);

UNIT 7 : Customization & CAD Drawing

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

UNIT 8 : Annotations Layering & Other Functions

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

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

Geometry And Topology Of Engineered Components Creation Of Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed toplogies for engineering, Introduction to Building Information Modeling (BIM)

List of sheets

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

Suggested Text/ Reference Books :

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

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

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

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

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

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

Syllabus for B.E. Semester I Department of Humanities

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

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

Course outcome

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

Course content

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

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

Course Code: ECT251 | **Course : Electronic Devices**

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

Course objective :

The objective of the course is to prepare the students:

1. To learn electrical properties, characteristics and behavior of basic solid state devices such as PN junction diode/BJT/MOSFET/JFET.
2. To develop analog applications in circuit design using device models.

Course outcomes:

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

1. Understand the applications of Diode Circuits.
2. Analyze different amplifier configurations & low frequency analysis of amplifier.
3. Understand FET Amplifier Circuits.
4. Know the fundamentals of VLSI and CMOS Technology.

Unit I

P-N junction as a Diode: – Characteristics, resistance, capacitance, small signal switching models, diode switching time; Diode Circuits, Rectifiers, Zener diode, shunt voltage regulator, Schottky diode, Varacter Diode, Tunnel Diode.

Unit II

Bipolar Junction Transistor: - Basics of BJT, configurations, Operation and Input/Output characteristics, Load line concept, Biasing Schemes, Bias stabilization, Compensation Techniques.

Unit III

Field effect Transistor: - JFET – Classification, construction, Operation, Characteristics; various configurations of FET amplifier (CS, CD, CG) and their features, Biasing schemes for FET amplifier, FET as VVR.

Unit IV

Frequency analysis of Amplifier: - Hybrid model, Determination of h-parameters from Input and Output characteristics, Analysis of amplifier circuit using h-parameters, simplified Hybrid model, estimation of voltage gain, current gain, input resistance, output resistance etc.

Unit V

Introduction to MOS Technology and VLSI: - Classification of ICs, MOS transistor, MOS capacitance, C-V characteristics, MOSFET I-V characteristics, Body Effect, Electrical properties of MOS, Introduction to MESFET and HFET.

Unit VI

CMOS Technology: - Digital Logic, MOSFET Approximations, CMOS Logic gates, CMOS Inverter, Pass Transistors and Transmission Gates, Tri-states, Pseudo-nMOS logic, CMOS domino logic, Dynamic CMOS Logic, Clocked CMOS (C^2MOS) Logic.

Text Books:

1. Integrated Electronics: *Millman, Halkias,Parikh TMH, 2nd Edition*
2. CMOS VLSI Design – A Circuits and Systems Perspective: *Neil Weste and David Harris, Addison-Wesley (Pearson), 4th Edition*

Reference Books:

1. Electronic devices and Circuit Theory: *R. Boylestad, Pearson Education 9th edition*
2. Foundation of Electronics Circuits and Devices: *Meade Thompson, 4th Edition*
3. Basic VLSI Design: *Douglas Pucknell and Kamran Eshraghian, PHI 3rd Edition.*
4. Solid State Electronic Devices: *Ben G. Streetman, Pearson Education 6th edition*
5. Electronic Devices and Circuits: *David A. Bell, PHI. 4th Edition*
6. An Introduction to semiconductor Devices: *Donald Nemen, Tata-McGraw Hill*
7. Electronic Circuits – Analysis and Design: *Donald Nemen, Tata-McGraw Hill*

Syllabus for B.E. Semester III

Course Code: ECP251 **Course : Electronic Devices Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course objective :

The objective of the course is to prepare the students:

1. To verify the characteristics of different electronic devices.
2. To use simulation software for analysis of electronic circuits

Course outcomes:

1. The students will be able to verify the characteristics of PN junction Diode, BJT and FET.
2. The students will be able to use the different electronic devices to design a system.
3. The students will be able to find the h-parameters from the characteristics of BJT.
4. The students will be able to use the simulation software – ORCAD for analysis of different electronic circuits and compare it with the hardware results

Experiments based on following topics:

PN Junction Diode Characteristics
Zener as Voltage Regulator
Rectifiers
Input/Output Characteristics of BJT
Biasing of BJT
Characteristics of JFET/MOSFET
CMOS Circuits
Circuit Simulation using ORCAD

Syllabus for B.E. Semester III

Course Code: ECT252 **Course : Digital System Design**

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

Course Objectives

1. To acquire the basic concepts of Verilog and application to understand digital systems.
2. To determine the output and performance of given combinational and sequential circuits.
3. To understand Hardware Implementation of design circuits using Verilog.
4. To acquire knowledge of various logic families of Digital circuits.

Course outcomes

1. To understand the concept of Verilog.
2. Design combinational and sequential circuits using Verilog.
3. Hardware Implementation using Programable logic Devices.
4. To understand various kinds of Logic families and its concepts.

Unit I –

Introduction to Logic Gates and implementation in Combinational Logic Design, Introduction to Verilog, Fundamentals of Verilog including language basics and relation to circuit implementation, Concept of SOP,POS and Karnaugh maps.

Unit II –

Modules and Ports in Verilog, modeling techniques in Verilog, Task and Functions, Synthesis and Simulation, Timing and delays, Verilog constructs and codes for combinational and sequential circuits.

Unit III –

Combinational Circuits (using Verilog): Comparators, Multiplexers and Demultiplexer, Encoder, Decoder, Halfand Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

Unit IV –

Sequential Circuits (using Verilog): Latches/buffers and Flip-Flops as memory storage elements, Counters, Shift registers and its variants, Memory and its internal organization, FSM design.

Unit V -

Concepts and Generic architecture of PAL, PLA, PLD and FPGA's, Synthesis and Implementation of Boolean functions using programable logic devices.

Unit VI -

Semiconductor Logic Families: TTL, ECL,CMOS and its study of Performance parameters, Project activity based on above curriculum.

Text Books:

1. R. P. Jain,“Modern digital Electronics”,Tata McGraw Hill, 4th edition, 2009.
2. Stephen Brown and Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design” Tata McGraw Hill, 3rd ed, 2009.

Reference Books:

1. Douglas Perry, “VHDL”, Tata McGraw Hill, 4thedition, 2002
2. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice” , PHI, 2nd edition ,2006
3. M. Morris Mano and Michael Ciletti,“Digital Design: With an Introduction to Verilog HDL", 5e, 2011
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989
5. Samir Palnitkar“Verilog HDL-A guide to Digital Design and Synthesis”SunSoft Press 1996
6. Charles Roth, “Digital System Design using VHDL” , Tata McGraw Hill 2nd edition

Syllabus for B.E. Semester III

Course Code: ECP252 **Course : Digital System Design Lab**
L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives

1. To acquire the basic concepts of Verilog and application to understand digital systems.
2. To determine the output and performance of given combinational and sequential circuits.
3. To understand basic requirement for a design application in Verilog.
4. To learn field programmable gate array (FPGA) technologies to synthesize and analyze digital systems.

Course outcomes

1. To use simulation tools to implement and test Verilog based design.
2. To design basic combinational and sequential circuits.
3. To design arithmetic blocks in Verilog and implement the same.
4. To design Verilog codes for small scale computer blocks.
5. To implement Verilog based designs on CPLD/FPGA.

Experiments based on following topics:

1. Combinational and sequential circuits.
2. Different techniques of modeling.
3. Verilog statements and test benches.
4. Design of arithmetic blocks in Verilog and implement the same.

Syllabus for B.E. Semester III

Course Code: ECT253 **Course : Signals and Systems**
L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Objectives

1. To introduce fundamental concepts and transforms as relevant to time and frequency domain signals.
2. To introduce ideas for analysis of continuous & discrete time system.

Course outcomes

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

1. Analyze different types of signals & systems.
2. Represent & analyze continuous and discrete systems in time and frequency domain.
3. Investigate stability of the system.
4. Sampling and reconstruction of a signal.
5. Understand characteristics of the state space models.

Unit I

Signals and systems as seen in everyday life, in various branches of engineering and science. Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Unit II

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input- output behavior with aperiodic & periodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations

Unit III

The Laplace Transform, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior. Notion of Eigen functions of LSI systems, a basis of Eigen functions.

Unit IV

The Sampling Theorem and its implications- Spectra of sampled signals. Aliasing and its effects. Relation between continuous and discrete time systems. The z-Transform for discrete time signals and systems- region of convergence, z-domain analysis. Concept of interpolation of signal.

Unit V

The notion of a frequency response of LSI and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Introduction to the Discrete-Time Fourier

Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's theorem.

Unit VI

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role in system analysis & design. The idea of signal, orthogonal bases, eigen values and eigen functions.

Text Books :.

1) B. P. Lathi, “Linear Systems and Signals”, OXFORD University Press.
2) Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
3) A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

Reference Books :

1) M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
2) J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
3) M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB",TMH, 2003.
4) J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
5) Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
6) R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
7) Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.

Syllabus for B.E. Semester III

Course Code: ECT254 **Course : Network Theory**

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

Course Objectives

The objective of the course is to make students capable of –

1. Analyzing different electrical networks.
2. Solving electrical circuits using suitable network theorems and methods.
3. Applying suitable transformation techniques to analyze electrical circuits in time and frequency domain.
4. Understanding different parameters of two port networks.

Course Outcomes

At the end of this course, students will be able to –

1. Understand and analyze basic electrical circuits using nodal and mesh analysis.
2. Understand the applicability of electrical network theorems; evaluate 3-phase circuits with unbalanced load.
3. Apply Laplace Transform for steady state and transient analysis.
4. Evaluate and analyze steady state response of networks to non-sinusoidal inputs.
5. Understand and apply basic frequency domain techniques.
6. Understand different parameters of two port networks.

Unit I : Node and Mesh Analysis, matrix approach of networks containing voltage sources, current sources, reactances, coupled circuits, source transformation, duality properties in the electrical networks.

Unit II : Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tellegen's theorem as applied to D.C. and AC. circuits.

Unit III : Analysis of RC, RL, and RLC networks with and without initial conditions using Laplace transform, transient behavior, evaluation of initial conditions, Waveform synthesis.

Unit IV : Steady state response of electrical networks to non-sinusoidal periodic inputs, three phase unbalanced circuit, power calculation, power factor, effective values.

Unit V : Concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorems

Unit VI : Two port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Text Books :

1) Sudhakar, A., Shyammohan, S. P.; “Circuits and Network”; Tata McGraw-Hill New Delhi, 1994.
2) Ravish R. Singh, “Electrical Networks” Tata McGraw Hill Education Private Limited (3 July 2008).
3) Van, Valkenburg.; “ Network analysis” ; Prentice hall of India, 2000.

Reference Books :

1) A William Hayt, “Engineering Circuit Analysis” 8th Edition, McGraw-Hill Education.

Syllabus for B. E. Semester III

Course Code: ECP255 **Course : Electronic Measurement Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives

1. To understand DC and AC bridges and their applications.
2. Learnaboutvariousmeasurementdevices,theircharacteristics,theiroperationandtheir limitations
3. Understand statistical data analysis
4. Understand computerized data acquisition.

Course outcomes

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

1. To analyze DC and AC bridges
2. Perform measurements using different instruments and reduce errors.
3. Perform statistical data analysis
4. Acquire data and perform signal conditioning.

Experiments based on :

DC bridge for Resistance Measurement (Quarter, Half and Full bridge)

AC bridge Circuit for capacitance measurement

Signal Conditioning circuit for Pressure Measurement

Signal Conditioning circuit for Temperature Measurement

Experimental study for the characteristics of ADC and DAC

Error compensation study using Numerical analysis using MATLAB (regression)

LABVIEW

Syllabus for B. E. Semester IV

Course Code: MAT255 **Course : Engineering Mathematics**

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

Course Outcomes

After studying the course, the student will be able to:

1. Solve field problems in engineering involving PDEs.
2. Understand complex variable.
3. Understand Laplace transforms, Z-transform to solve engineering problems.

Module 1:

Complex Variable – Differentiation: (8 lectures)

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

Module 2:

Complex Variable – Integration: (9 lectures)

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

Module 3:

Partial Differential equations: (8 lectures)

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

Module4:

Laplace Transform:(10 lectures)

Laplace transforms and their properties, Application of Laplace Transform to solve differential equations.

Module 5:

Z-Transform(9 lectures)

Formation and solution of difference equations, definition and properties of Z- Transform, its inversion, relation with Laplace transform, application of Z-transform to solve difference equations with constant coefficient.

Text Book:
1. B. S. Grewal, Higher Engineering Mathematics, Khanna publishwers 43 rd edition (2015).
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:
1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Syllabus for B. E. Semester IV

Course Code: HUT256 **Course : Indian Traditional Knowledge**
L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 00**

Course Outcomes
Students will have increased ability to understand the importance and application of:
1. Indian Knowledge system and its scientific approach
2. Indian philosophical tradition
3. Indian artistic tradition
4. Traditional knowledge and protection of nature
5. The legality and its importance for the protection of Indian traditional knowledge

1. Basic Structure of Indian Traditional Knowledge : Vedas, Upavedas, Vedang, Upadang, scientific approach
2. Ecology and Indian Traditional Knowledge : Meaning, role, case studies
3. Intellectual Property Rights and Indian traditional Knowledge : Meaning, role in protection of Indian traditional knowledge, cases studies
4. Indian Philosophical Traditions: Nyay, Sankaya, Yog, Mimansa, Jainism, Buddhism, Sikhism, and other approaches
5. 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, Bharatiya Vidya Bhavan, Mumbai, 5 th 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. Semester IV

Course Code: ECT256 **Course : Analog and Digital Communication**
L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 03**

Course Objectives
Student should be able
1. To evaluate and compare various analog modulation schemes
2. To analyze the behavior of noise in communication system
3. To investigate digital modulation schemes
4. To analyze detection techniques in digital communication modulation systems

Course outcomes :
At the end of this course students will demonstrate the ability to
1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise
3. Investigate pulsed modulation system and analyze their system performance
4. Analyze different digital modulation schemes and can compute the bit error performance

Unit I
Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

Unit II
Noise in amplitude modulation systems, Noise in Frequency modulation systems, Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

Unit III
Pulse modulation, Sampling process, Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

Unit IV
Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations, Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion

Unit V
Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.
Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation. Recent trends in modern communication systems

Text Books:
1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. B. P. Lathi, “Modern Digital and Analog Communication Systems”, Third Edition, Oxford University press.

Reference books:
1. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002
2. Taub H. and Schilling D.L., "Principles of Communication Systems” , Tata McGraw Hill, 2001.
3. Wozencraft J. M. and Jacobs I. M., `Principles of Communication Engineering'',John Wiley, 1965.
4. Barry J. R., Lee E. A. and Messerschmitt D. G.,'Digital Communication'', Kluwer Academic Publishers, 2004.
5. Proakis J. G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.
6. George Kenndey, 4th Edition , “ Electronics Communication systems ”

Syllabus for B.E. Semester IV

Course Code: ECP256 **Course : Analog and Digital Communication Lab**
L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives
1. To observe and interpret the performance of Analog Communication systems
2. To observe and interpret the performance of digital Communication systems
3. To explore communication software.

Course outcomes
On completion of this Lab students will be able:
1. To observe and interpret the performance of AM modulator and demodulator under various changing parameters.
2. To understand FM Modulation and Demodulation.
3. To closely observe the effect of change of sampling frequency, duty cycle and order of filter in sampling and reconstruction.
4. To get the experience of working on software packages like MATLAB.

Experiments based on the following topics
- Amplitude Modulation
- Frequency Modulation
- Pulse Code Modulation
- Delta Modualation
- Adaptipe Delta Modualation
- TDM
- Communication Receiver
- Communication Software Study
- Digital Modulation Scheme

Syllabus for B.E. Semester IV

Course Code: ECT257 **Course : Analog Circuits**

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

Course Objectives

To make students aware about

1. Concepts related to frequency response of bipolar amplifiers at high frequency.
2. Use of feedback in amplifiers and oscillators
3. Fundamentals of Differential amplifier and various applications of op-amp
4. Concepts related to active filters and timer, used in analog circuits

Course outcomes

1. To understand feedback amplifier and oscillator circuit using BJT
2. To understand the concepts of BJT at high frequency
3. To understand differential amplifier circuits and various applications of op-amp
4. To understand fundamentals of active filters & IC 555

Unit I : Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

Unit II : High frequency transistor models, frequency response of single stage and multistage amplifiers, various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

Unit III : Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc)

Unit IV : Differential amplifier, DC and AC analysis, Constant current Bias circuits, Level shifting techniques, cascaded, differential amplifier stages

Unit V : OP-AMP and its applications: Block diagram of op-amp, Ideal and practical characteristics of Op-amp, Inverting and non-inverting amplifiers, integrator and differentiator, Adder and Subtractor amplifier, precision rectifier, Schmitt trigger.

Unit VI : Active filters: Design of Butterworth n^{th} order filter – Low pass, high pass, band pass and band stop filters. Introduction to IC 555 and its application. Recent trends in analog circuits.

Text Books:

1. Integrated Electronics: Millman, Halkias, Parikh TMH, 2 Edition
2. Electronic Devices and Circuit Theory: R. Boylestad, Pearson Education, 9 Edition
3. Design with Operational Amplifiers and Analog Integrated Circuits: Sergio Franco, TMH, 3 Edition
4. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.

Reference Books:

1. A.S. Sedra and K.C. Smith, Microelectronic Circuits,
2. Electronic Devices and Circuits: David A. Bell, PHI. 4 Edition
3. Operational Amplifier: Ramakant Gaikwad.
4. Linear Integrated Circuits: D. Roy Choudhary, Shail Jain, New Age International.

Syllabus for B.E. Semester IV

Course Code: ECP257 **Course : Analog Circuits Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives

1. To demonstrate frequency response of bipolar amplifiers at high frequency.
2. Analyze effect of feedback in an amplifier and oscillator.
3. Use op-amp to realize various circuits
4. Implement active filter and timer in the analog circuits

Course outcomes

1. The students will be able to determine the frequency response of an amplifier.
2. The students will be able to design feedback and Oscillator circuits
3. To know the use of operational amplifier in various applications
4. To design Astable / Monostable multivibrator using IC 555.

Experiments based on following topics:

RC coupled amplifier using BJT

Feedback amplifier circuits

Osclillator using BJT

Linear and non linear Applications of OPAMP

IC 555

Syllabus for B.E. Semester IV

Course Code: ECT258 **Course : Microprocessors**

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

Course Objectives

1. This course will make student aware of evolution of microprocessors and their advancement in recent time.
2. This course will impart the concept of assembly programming for real life problems.
3. This course will make student aware of hardware interfaces needed to develop a microcomputer system.
4. This course will prepare students to develop application based microcomputer system with optimum utilization of hardware resources and efficient programs.

Course outcomes

1. To understand the organization of microprocessors in a microcomputer system.
2. To develop algorithms in assembly language codes for desired microprocessor.
3. To understand the hardware interfacing concepts of IO, memory and peripherals with microprocessors.
4. To interpret the advancements in microprocessor with recent trends and development.

Unit I : Introduction to Intel's 8085 Architecture and its description along with functional pin diagram, organization of Memory in microcomputer system. Flag structure, Addressing Modes & Instruction set of 8085.

Unit II : Assembly language Programming and timing diagram of instructions. Concept of Interrupts and its structure in 8085 & Interrupt service routines. Memory interfacing/ mapping with 8085 (RAM/ROM/EPROM).

Unit III : Architecture of 8255PPI and its interfacing with 8085, Interfacing of I/O devices like ADC, DAC, Stepper Motor, LEDs, 7-segment LED Displays using 8255.

Unit IV : Introduction to 16 bit processor 8086, CPU architectures, Register set, flags, Memory organization, Signal Descriptions.

Unit V : Instruction set, pseudo operations, assembler directives. Assembly language programming (MASM/TASM support). Stack concepts, Interrupts (hardware/software) and their routines.

Unit VI : 8086 Maximum mode system, Real and Virtual memory & protected mode. CPU Nomenclature and features: 286, 386, 486, Pentium.

Text Books:

1. Microprocessor: Architecture, Programming & applications with 8085; Ramesh S.Gaonkar; Penramth International, 5 Edition.
2. Advanced Microprocessors and Peripherals; A. K. Ray & K. M. Bhurchandi; McGraw Hill, 3rd Edition.

Reference Books:

1. 8085 Microprocessor: Programming and Interfacing; N. K. Srinath; PHI, 1 Edition.
2. Microcomputer systems: the 8086/8088 family: Architecture, Programming, and Design; Yu-chengnd Liu, Glenn A. Gibson; Prentice-Hall, 2 Edition.

Syllabus for B.E. Semester IV

Course Code: ECP258 **Course : Microprocessors Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Objectives

1. This course will make student aware of assembly language programming and its debugging techniques.
2. This course will make student aware of generic hardware interfaces needed to develop a microcomputer system.

Course outcomes

1. To understand Assembly language programming for microprocessor 8085 and 8086.
2. To understand hardware interfacing with microprocessors and its programming.

Experiments based on following topics:

Assembly language programs based on logical and arithmetic instructions with 8085 microprocessor.

Assembly language programs based on hardware interface modules with 8085 microprocessor.

Algorithm development for 8086 microprocessor on MASM/TASM.

Syllabus for B.E. Semester IV

Course Code: ECT259 **Course : Probability Theory and Stochastic Processes**

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

Course Objectives

1. To study probability theory and analyze random signals.
2. To interpret random process.
3. To apply techniques for analysis of random signals & processes.
4. To study the influence of random signal in LTI system.

Course outcomes

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

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

Unit I

Introduction to probability, sets, fields, events, Axiomatic definition of probability, Joint, Conditional and Total Probabilities, Bayes theorem and applications.

Unit II

Introduction and Definition of a Continuous & Discrete Random Variables, Probability / Cumulative Distribution Function, Probability Density Functions, Conditional and joint distributions and densities, Functions of Random Variables. Moments of random variable.

Unit III

Expectation and introduction to estimation: Conditional Expectations, Moments. Markov and Chebyshev Inequalities. Characteristic functions of a random variable; Chernoff bounds.

Unit IV

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

Unit V

Basic Definitions and Important Random Processes, Useful classifications of Random Processes. Stationary processes. Mean and covariance functions. Noises in communication system: Gaussian noise, white noise, colored noise

Unit VI

Introduction to LTI Systems. Transmission of random process through LTI system. Parseval's theorem for Energy & Power spectral density.

Text Books:

1) A.Papoulis and S. Unnikrishnan Pillai, 'Probability, Random Variables and Stochastic Processes, Fourth Edition, McGraw Hill
2) H. Stark and J. Woods,`Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education
3) S. Palaniammal, “Probability And Random Processes” PHI publication.

Reference Books:

1) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
2) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
3) S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Syllabus for B.E. Semester IV

Course Code: PHT251 **Course : Introduction to Electromagnetic Theory**

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

Course Objectives

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

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

MODULE I:

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

MODULE II:

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

MODULE III:

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

MODULE IV:

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

MODULE V:

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

MODULE VI:

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

Text Books:

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

Reference Books:

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

Syllabus for B.E. Semester IV, Open Electives -I

Course Code: ECT299 – 1 **Course : Renewable Energy**

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

Course Objective

The students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

Course outcomes

1. To Understand the Need, importance and scope of non conventional and alternate energy resources.
2. To understand role significance of solar energy.
3. To provide importance of Wind Energy.
4. To understand the role of ocean energy in the Energy Generation.
5. To get the utilization of Biogas plants and geothermal energy
6. To understand the concept of energy Conservation.

Unit I:

SOLAR ENERGY

Solar Radiation, Measurements of Solar Radiation, Flat Plate And Concentrating Collectors, Solar Direct Thermal Applications, Solar Thermal Power Generation, Fundamentals of Solar Photo Voltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV Applications.

Unit II:

WIND ENERGY

Wind Energy Estimation, Types of Wind Energy Systems, Performance, Site Selection, Details of Wind Turbine Generator.

Unit III:

OCEAN ENERGY

Ocean Thermal Energy Conversion (OTEC), Principle of operation, development of OTEC plants, Tidal and wave energy, Potential and conversion techniques, mini-hydel power plants.

Unit IV:

BIO-MASS

Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gasdigesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

Unit V:

GEOTHERMAL ENERGY

Resources, types of wells, methods of harnessing the energy, scope in India.

Unit VI:

ENERGY CONSERVATION

Principles of energy conservation, the different energy conservation appliances, cooking stoves, Benefits of improved cooking stoves over the traditional cooking stoves

Text Books:

1. Reneweble energy resources: Tiwari and ghosal, Narosa publication.
2. Non conventional Energy Sources, Khanna Publication

Reference Books:

1. Renewable Energy Sources:Twidell & Weir, CRC Press.
2. Solar Energy/ S.P. Sukhatme, Tata McGraw-Hill.
3. Non Conventional Energy Systems: K M. Mittal, A H *Wheeler* Publishing Co Ltd.
4. Renewable Energy Technologies: Ramesh & Kumar, Narosa Publication.
5. Biomass Energy, Oxford & IBH Publication Co.

Syllabus for B.E. Semester IV, Open Electives -I

Course Code: ECT299 – 2 **Course : Evolution in Communication Technologies**

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

Course Objectives

The objective of this course is

1. To give students the knowledge of basics of telecommunication systems and its applications.
2. To give students the overview of function of optical fiber communication systems, Satellite communication system and its importance in telecommunications.
3. To give knowledge of various wireless standards used worldwide and concepts in mobile communications.

Course Outcomes

On completion of this course students will be able:

1. To acquire the fundamental concepts of Telecommunication Engineering.
2. To understand use of different modulation techniques used in Analog and Digital Communication.
3. To acquire basic knowledge of different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.
4. To Compare and contrast advantages and limitations of various Telecommunication systems.

Unit I

Basics of Telecommunication Engineering:

Definition of Telecommunication, Examples of telecommunications and evolution, various types of telecommunication systems such as telephone network, Radio broadcasting system, Computer networks, Internet etc.

Unit II

Basic Elements of Telecommunication systems

General Block schematic of communication system, Communication channels, Analog versus digital communication systems, Need of modulation, Types of analog modulation such as AM and FM, Types of digital modulation such as Pulse code modulation, delta modulation, Continuous wave modulation such as ASK, FSK, PSK.

Unit III

Introduction to Optical Fiber Communication

Use of optical fiber in communication, Principle and working of OFC system, Block diagram, Types of optical fibers, various elements required in designing OFC system, Applications such as long distance transmission links, Computer communication networks etc.

Unit IV

Introduction to Satellite Communication

Use of satellite in telecommunications, Launching of Satellite from earth station, Types of satellite orbits, Classification of satellite according to applications, Satellite communication link block diagram.

Unit V

Some concepts in Wireless communications

Wireless Standards: Overview of 2G and 3G, 4G cellular standards, Multiple access schemes-FDMA, TDMA, CDMA and OFDM, Modulation schemes- BPSK, QPSK.

GSM, Wi-Fi & Wi-Max, Bluetooth, Recent Trends/Developments.

Unit VI

Basics of Mobile Communication

Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control;

Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation.

Antennas for mobile terminal- monopole antennas, base station antennas and arrays.

Text Books

1) Communication Electronics: *Simon Haykin, 4th Edition, John Wiley Publication.*
2) George Kenndey, *4th Edition , " Electronics Communication systems "*
3) *Digital Communication: John G. Proakis, Tata McGraw Hill*
4) *Satellite Communication : T . Prat, C.W. Bostian, Wielly Publication*

Reference Books

1. Wireless communication – Principles and Practice: *Theodore S. Rappaport, Pearson Education.*
2. Optical Fiber Communication – Principles and Practice: *John M. Senior, Pearson Education.*

Syllabus for B.E. Semester IV

Course Code: CHT252 **Course : Environmental Science**

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

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's outlook, 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.

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) P Aarne Vesilind, 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 IV, Honors Course

Course Code: ECTH41 **Course : Communication System Analysis**

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

Course Objectives

The objective of this course is

1. To understand advanced concepts in communication systems.
2. To know various advanced modulation techniques.
3. To understand advanced concepts like synchronization, channel estimation

Course Outcomes

On completion of this course students will be able:

1. To understand the advanced concepts in communication systems.
2. To understand advanced modulation techniques.
3. To know advanced concepts like synchronization, channel estimation
4. To analyze the behavior of ATM traffic in presence of congestion

Unit I

Spread Spectrum Communications: Spreading sequences- Properties of Spreading Sequences, Pseudo- noise sequence, Gold sequences, Kasami sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes Direct sequence spread spectrum – DS-CDMA Model, Conventional receiver, Rake Receiver, Synchronization in CDMA, Power Control, Soft handoff

Unit II

Orthogonal Frequency Division Multiplexing: Basic Principles of Orthogonality, Single vs Multicarrier Systems, OFDM Signal Mathematical Representation, Selection parameter for Modulation, Pulse shaping in OFDM Signal and Spectral Efficiency, Window in OFDM Signal and Spectrum, Synchronization in OFDM, Pilot Insert in OFDM Transmission and Channel Estimation

Unit III

MIMO Systems: Introduction, Space Diversity and System Based on Space Diversity, Smart Antenna system and MIMO, MIMO Based System Architecture, MIMO Exploits Multipath, Space – Time Processing, Antenna Consideration for MIMO, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Cyclic Delay Diversity (CDD), Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond, MIMO-OFDM

Unit IV

SONET/SDH: Architecture, SONET Layers, SONET Frames, STS Multiplexing, SONET Networks, Virtual Tributaries. ATM: Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols.

Unit V

ATM Traffic and congestion Control: Requirements for ATM Traffic and Congestion Control, Cell Delay Variation, ATM Service Categories, Traffic and Congestion Control Framework, Traffic Control, Congestion Control

Text Books:

1. Gary J. Mullett, “Introduction to Wireless Telecommunications Systems and Networks”, CENGAGE
2. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009
3. William Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM” Prentice Hall, 4th edition

Reference books:

1. Ke-Lin Du & M N S Swamy, “Wireless Communication System”, Cambridge University Press, 2010
2. Behrouz A Forouzan, “Data Communications and Networking”, 4th Edition, McGraw Hill.

Syllabus for B.E. Semester IV, Minors Course

Course Code: ECTM41 – 1 **Course : Electromagnetic Fields**

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

Course Objectives

The objective of this course is

1. To understand physical significance of mathematical concepts such as Gradient, Divergence and Curl.
2. To have Basic understanding of Maxwell's equations and its application in static and Time Varying Fields.
3. To understand Uniform Plane Wave propagation in different media.
4. To understand Electric and Magnetic Field Theory.

Course Outcomes

On completion of this course students will be able:

1. To understand the underlying concepts of vector algebra
2. To have Basic understanding of Maxwell's equations and its application in static and time-varying fields.
3. To understand uniform plane wave propagation in different media
4. To understand the electric and magnetic field theory.

Unit – I

Vector Algebra & Co-ordinate Geometry: Cartesian, Cylindrical and Spherical co-ordinate systems, differential lengths, surfaces and volumes. Gradient, divergence & curl of a vector & their physical interpretation, Irrotational and Solenoidal fields.

Unit – II

Electric Fields: Electrostatic fields, Coulumb's law, Electric field for different charge distributions. Gauss law & its applications. Electric potentials for different charge distributions. Poisson's & Laplace equations.

Unit – III

Magnetic fields: Lorentz law, Biot-savert law, Magnetic field due to different current distributions. Gauss law & Ampere's law. Magnetic vector potential & magnetic flux, Lenz's law, Faraday's law.

Unit – IV

Maxwell's Equations: Electric scalar potential, displacement current, Maxwell's equations for time varying fields & their physical significance.

Unit – V

Uniform Plane Wave: Poynting vectors theorem & its proof, Maxwell's equations in phasor form, Transformation of time varying quantity into phasor, Transformation of phasor into time varying quantity, Uniform plane wave, Wave equation, Propagation constant, attenuation constant, phase constant.

Unit – VI

Wave Motion: Solution of wave equation in free space, relation between E & H vectors, intrinsic impedance, frequency, wavelength, velocity, wave equations & their solutions in conducting & dielectric media, Skin effect, Depth of Penetration.

Text Books:

1. "Engineering Electromagnetics": *William Hyat, John Buck ; Tata McGraw Hill.*
2. Electromagnetic Waves & Radiating Systems: *Advard C. Jordan, Keith G. Balman, Second Edition, Prentice-Hall of India Pvt. Ltd.*

Reference Books:

1. Problems and Solutions in Electromagnetics: *W. H. Hyat, J. A. Buck, Tata McGraw Hill Education Private Limited, New Delhi.*
2. Theory and Problems of Electromagnetics: *Joseph A. Edminister, Schaum's outline series in Engineering, McGraw Hill Book Company.*
3. Electromagnetic Fields: *K. B. Madhu Sahu, 2nd Edition, Scitech Publications Pvt ltd.*

Syllabus for B.E. Semester IV, Minors Course

Course Code: ECTM41 – 2 **Course : Analog and Digital Communication**

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

Course Objectives

Student should be able

1. To evaluate and compare various analog modulation schemes
2. To analyze the behavior of noise in communication system
3. To investigate digital modulation schemes
4. To analyze detection techniques in digital communication modulation systems

Course Outcomes

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

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise
3. Investigate pulsed modulation system and analyze their system performance
4. Analyze different digital modulation schemes and can compute the bit error performance

Unit I:

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

Unit II

Noise in amplitude modulation systems, Noise in Frequency modulation systems, Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

Unit III

Pulse modulation, Sampling process, Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

Unit IV

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations, Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion

Unit V

Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

Unit VI

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels-Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation. Recent trends in modern communication systems

Text Books

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. B. P. Lathi, “Modern Digital and Analog Communication Systems”, Third Edition, Oxford University press
3. George Kenndey, 4th Edition , “ Electronics Communication systems ”

Reference Books

1. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
2. Taub H. and Schilling D.L., "Principles of Communication Systems” , Tata McGraw Hill, 2001.
3. Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering" John Wiley, 1965.
4. Barry J. R., Lee E. A. and Messerschmitt D. G., "Digital Communication", Kluwer Academic Publishers, 2004.
5. Proakis J.G., "Digital Communications", 4th Edition, McGraw Hill, 2000.

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