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Shri Ramdeobaba College of Engineering and Management, Nagpur

SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

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

PROGRAMME SCHEME

2022-2023

B. TECH. (ELECTRICAL ENGINEERING)

Salient Features of the Department

- The Department of Electrical Engineering was established in the year 1984 with a sanctioned UG intake of 60 students. The National Board of Accreditation has accredited the UG program fivetimes in succession in the year 2001, 2006, 2012, 2017 and 2020. Presently, the ElectricalEngineering Department also has a post graduate program (M. Tech. in Power Electronics andPower Systems) with sanctioned intake of 12, started from 2011. Department is a RecognizedResearch Centre, approved by RTM Nagpur University for Doctoral program and has sixteen well-equipped laboratories.
- The department has well qualified and experienced faculty with industrial background and comprises of one Professor, three Associate Professors and nine Assistant Professors on roll. They have undertaken many consultancy projects and have been granted patent by government of India. Also, the faculty members are working on various research projects sponsored by different funding agencies including AICTE, RGSTC and UBA.
- The department has a conducive environment for the academic and overall development of students. Two student bodies are active in the department. One is the IEEE Student Joint Chapter and the other one is Electrical Engineering Students Association (EESA). They provide a platform for promoting the curricular, co-curricular and extracurricular students activities. The students of this department actively participate in sports and represent the college at various levels. Students are keenly interested in contributing for social cause and join the National Service Scheme (NSS) activities. Department organizes Seminars, Guest lectures, Value Added courses, Training programs and Product exhibitions for the students. Students get opportunity to enhance their technical skill by participating in the training program like PLC based automation, Photovoltaic Plant Design and Installation, IoT Applications etc. The curricula of both UG & PG programs is designed as per choice based creditsystem and current requirements of industry.
- There is a provision by which students can qualify and secure the award of Minor Specialization in any other discipline of their interest like Computer Science, Electronics, Mechanical etc. This is in addition to the degree belonging to core branch of Electrical Engineering. Such blend of two qualifications during the same period of four years increases the employability of students multiple times.
- To introduce the graduating students to the latest developments in the industry, the department organizes Technical Workshop cum Exhibition named “EMPOWER". This mega event was organized in the department for five times in year 2012, 2013, 2014, 2017 and 2018. Reputedcompanies namely ABB Limited, ARCTIC Infra Tech, GRANDSTREAM, Grundfos, Hager, Hioki, KEI Cables, L&T, Powerica, Wipro, Bergen, Biosys, HP, Rockwell Automation, Schneider, Siemens, Texas Instruments, Finolex, Highrise Transformers, TDK, Waree, Gentech, Synergy, VSP aqua mist etc. participated in the exhibition with the wide range of products to display.
- On academic front, the department results are consistently good. The department has an Entrepreneur Development Cell to develop the entrepreneurial skills among the students. The department highly encourages the industry interaction. Students are permitted to avail one full semester internship in industry without any academic load in the college. So far, every year more than 80% students get placed in different companies through on-campus drive with multiple job-offers in hand even before the completion of final year of graduation. Many students have secured admission at IITs, NITs and other higher ranked institutes including foreign universities for their Masters’ education.

Department Vision

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

Department Mission

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

Program Educational Objectives

PEO1: Our graduates will be able to plan, design, operate and practice in electrical and energy systems.

PEO2: Our graduates will be able to work in multidisciplinary environments including IT applications and adapt themselves as per the emerging technological needs of Industry.

PEO3: Our graduates will be able to progress in their career by demonstrating in practice the technical and communication skills effectively with understanding of ethical and social values.

Program Outcomes

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

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

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

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

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

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

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

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

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

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

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

PSO1: Analyze ,design and develop Electrical Engineering systems considering green energy aspects in emerging applications like Electric vehicles, renewable energy etc.

PSO2: Apply the knowledge of modern IT tools to Electrical Engineering applications.

Teaching Scheme for B.Tech. Electrical Engineering

First Year Group1: Semester-I / Group2: Semester-II

Sr. No.	Code	Course	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Continuous Evaluation	End Sem Exam	Total		
1.	PHT152	Oscillations, waves and Optics	3	1	0	4	40	60	100	03	BS
2.	PHP152	Oscillations, Waves and Optics Lab	0	0	3	1.5	25	25	50	–	BS
3.	MAT152/ MAT151	Differential Equations, Linear Algebra, Statistics & Probability/ Calculus	3	0/1	0	3/4	40	60	100	03	BS
4.	MAP151	Computational Mathematics Lab	0	0	2	1	25	25	50	–	BS
5.	EET151	Basic Electrical Engineering	3	1	0	4	40	60	100	03	ES
6.	EEP151	Basic Electrical Engineering Lab	0	0	2	1	25	25	50	–	ES
7.	MET151	Engineering Graphics and Design	1	0	0	1	40	60	100	03	ES
8.	MEP151	Engineering Graphics and Design Lab	0	0	4	2	50	50	100	–	ES
9.	HUT152	Constitution of India	2	0	0	0	–	–	–	–	HSS
10.	PEP151	Yoga/Sports	0	0	2	0	–	–	–	–	Other
		TOTAL	12	2/3	13	17.5/18.5					

First Year Group 2: Semester - 1 / Group 1: Semester - II

Sr. No.	Code	Course	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Continuous Evaluation	End Sem Exam	Total		
1.	CHT151	Chemistry	3	1	0	4	40	60	100	03	BS
2.	CHP151	Chemistry Lab	0	0	3	1.5	25	25	50	–	BS
3.	MAT151/ MAT152	Calculus/ Differential Equations, Linear Algebra, Statistics and Probability	3	1/0	0	4/3	40	60	100	03	BS
4.	CST151	Programming for Problem Solving	4	0	0	4	40	60	100	03	ES
5.	CSP151	Programming for Problem Solving Lab	0	0	2	1	25	25	50	–	ES
6.	IDT151	Creativity, Innovation and Design Thinking	1	0	0	1	20	30	50	1.5	Other
7.	INT151	Workshop/Manufacturing Practices	1	0	0	1	20	30	50	1.5	BS
8.	INP151	Workshop/Manufacturing Practices Lab	0	0	2	1	25	25	50	–	BS
9.	HUT151	English	2	0	0	2	40	60	100	03	HSS
10.	HUP151	English Lab	0	0	2	1	25	25	50	–	HSS
		TOTAL	14	2/1	9	20.5/19.5					

BS: Basic Sciences; ES: Engineering Sciences; HSS: Humanities and Social Sciences, PC: Program Core; PE: Program Electives, OE: Open Electives, Project, Int: Internships/Seminars, Other

Semester III

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total		
1.	MAT256	Electrical Engineering Mathematics	3	0	0	03	40	60	100	3	PC
2.	EET253	Data Structures and Algorithms	3	0	0	03	40	60	100	3	ES
3.	EEP253	Data Structures and Algorithms Lab	0	0	2	01	25	25	50	3	ES
4.	EET251	Network Analysis	3	1	0	04	40	60	100	3	PC
5.	EEP251	Network Analysis Lab	0	0	2	01	25	25	50	3	PC
6.	ENT259	Analog Electronic Circuits	3	0	0	03	40	60	100	3	ES
7.	ENP259	Analog Electronic Circuits Lab	0	0	2	01	25	25	50	3	ES
8.	EET252	Electrical Measurements and Instrumentation	2	1	0	03	40	60	100	3	PC
9.	EEP252	Electrical Measurements and Instrumentation Lab	0	0	2	01	25	25	50	3	Pc
10.	MBT251	Innovation and Entrepreneurship	3	0	0	03	40	60	100	3	HSS
11.	CHT251	Environmental Science	2	0	0	00	-	-	-	-	Other
		TOTAL	19	02	08	23					

Semester IV

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total		
1.	EET271	Signals and Systems	2	1	0	03	40	60	100	3	PC
2.	ENT260	Digital Circuits and Microprocessor	3	0	0	03	40	60	100	3	ES
3.	ENP260	Digital Circuits and Microprocessor Lab	0	0	2	01	25	25	50	3	ES
4.	EET272	Electrical Machines-I	3	1	0	04	40	60	100	3	PC
5.	EEP272	Electrical Machines-I Lab	0	0	2	01	25	25	50	3	PC
6.	EET276	Power System-I	3	0	0	03	40	60	100	3	PC
7.	EET277	Object Oriented Programming	3	0	0	03	40	60	100	3	ES
8.	EEP277	Object Oriented Programming Lab	0	0	2	01	25	25	50	3	ES
9.	EET299	Open Elective-I	3	0	0	03	40	60	100	3	OE
10.	HUT252	Indian Traditional Knowledge	2	0	0	00	-	-	-	-	HSS
		TOTAL	19	02	06	22					

BS: Basic Sciences; ES: Engineering Sciences; HSS: Humanities and Social Sciences, PC: Program Core; PE: Program Electives, OE: Open Electives, Project, Int: Internships/Seminars, Other

Open Elective: 1

EET299-2	Renewable Energy Systems
EET299-3	Elements of Electrical Technology

Semester V

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total		
1.	EET352	Electrical Machines-II	3	1	0	04	40	60	100	3	PC
2.	EEP352	Electrical Machines-II Lab	0	0	2	01	25	25	50	3	PC
3.	EET353	Microcontroller	3	0	0	03	40	60	100	3	PC
4.	EEP353	Microcontroller Lab	0	0	2	01	25	25	50	3	PC
5.	EET354	Program Elective-I	3	0	0	03	40	60	100	3	PE
6.	EET355	Power Electronics	3	1	0	04	40	60	100	3	PC
7.	EEP355	Power Electronics Lab	0	0	2	01	25	25	50	3	PC
8.	EET358	Database Management Systems	3	0	0	03	40	60	100	3	ES
9.	EEP358	Database Management Systems Lab	0	0	2	01	25	25	50	3	ES
10.	EET398	Open Elective-II	3	0	0	03	40	60	100	3	OE
11.	EEP359	Simulation Lab*	0	0	2	01	50	--	50	3	PC
		TOTAL	18	02	10	25					

* Laboratory course with internal evaluation.

BS: Basic Sciences; ES: Engineering Sciences; HSS: Humanities and Social Sciences, PC: Program Core; PE: Program Electives, OE: Open Electives, Project, Int: Internships/Seminars, Other

Program Elective: 1

EET354-5	Electromagnetic Fields
CET371	Engg. Mechanics and Strength of Materials
IDT351	Biology for Engineers
EET354-3	Electrical Energy Conservation and Audit
EET354-4	Industry Offered Elective-I

Open Elective: II

EET398-4	Electrical Appliances
EET398-5	Energy Storage Systems

Semester VI

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Continuous Evaluation	End Sem Exam	Total		
1.	EET371	Power System–II	3	0	0	03	40	60	100	3	PC
2.	EEP371	Power System–II Lab	0	0	2	01	25	25	50	3	PC
3.	EET372	Control Systems	3	1	0	04	40	60	100	3	PC
4.	EEP372	Control Systems Lab	0	0	2	01	25	25	50	3	PC
5.	EET373	Program Elective-II	3	0	0	03	40	60	100	3	PE
6.	EET374	Program Elective-III	3	0	0	03	40	60	100	3	PE
7.	EEP374	Program Elective-III Lab	0	0	2	01	25	25	50	3	PE
8.	EET399	Open Elective-III	3	0	0	03	40	60	100	3	OE
9.	EEP378	*Mini Project	0	0	2	01	50	-	50	3	Pr
10	EEP377	Comprehensive Viva	0	0	2	01	25	25	50	3	PC
TOTAL			15	01	10	21					

BS: Basic Sciences; ES: Engineering Sciences; HSS: Humanities and Social Sciences, PC: Program Core; PE: Program Electives, OE: Open Electives, Project, Int: Internships/Seminars, Other

Program Elective – II and III

Program Elective	***Power System Track***	***Control, Automation and Drives Track***	***Renewable Energy & Electric Vehicle***	***Other***	
II	Power Station Practice EET373-2	Electric Drives and Control EET373-5	Non-Conventional Energy Sources EET373-6	Utilization of Electrical Energy EET373-3	Industry Offered Elective-II EET373-4
III(T)	Electrical M/C Design EET374-6	PLC and SCADA EET374-7	Photovoltaic System Engineering EET374-5		
III(L)	Electrical Workshop EEP374-8	PLC and SCADA(L) EEP374-7	Photovoltaic System Engineering(L) EEP374-5		

Open Elective: III

EET399-1	Solar Photovoltaic Systems
EET399-2	Automation with PLC

Semester VII

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Continuous Evaluation	End Sem Exam	Total		
1.	EET452	Program Elective-IV	3	0	0	03	40	60	100	3	PE
2.	EEP452	Program Elective-IV Lab	0	0	2	01	25	25	50	3	PE
3.	EET456	Power System Protection	3	0	0	03	40	60	100	3	PE
4.	EEP456	Power System Protection-Lab	0	0	2	01	25	25	50	3	PE
5.	EET498	Open Elective-IV	3	0	0	03	40	60	100	3	OE
6.	HUT453	Engineering Economics and Management	3	0	0	03	40	60	100	3	HSS
7.	EEP454	Industry Internship Evaluation	0	0	2	00	50	-	50	-	Pr
8.	EEP455	Project Phase-I	0	0	6	03	100	-	100	-	Pr
		TOTAL	12	00	12	17					

BS: Basic Sciences; ES: Engineering Sciences; HSS: Humanities and Social Sciences, PC: Program Core; PE: Program Electives, OE: Open Electives, Project, Int: Internships/Seminars, Other

Program Elective-IV:

Program Elective	***Power System Track***	***Control, Automation and Drives Track***	***Renewable Energy & Electric Vehicle***
IV(T)	High Voltage Engineering EET452-7	Digital Signal Processing EET452-8	IoT Applications for Energy EET452-9
IV(L)	High Voltage Engineering (L) EEP452-7	Digital Signal Processing (L) EEP452-8	IoT Applications for Energy(L) EEP452-9

Open Elective: IV

EET498-1	Electric Vehicles
EET498-3	Energy Management and Audit

Semester VIII

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)	Category
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total		
1.	EET472	Program Elective-V	3	0	0	03	40	60	100	3	PE
2.	EET473	Program Elective-VI	3	0	0	03	40	60	100	3	PE
3.	EEP474	Project Phase-II	0	0	16	08	100	100	200	3	Pr
		TOTAL	06	00	16	14			400		
		OR									
	EEP476	Full Semester Internship (Industry/ Research /TBI)	--	--	16	14	200	200	400		Pr

BS: Basic Sciences; ES: Engineering Sciences; HSS: Humanities and Social Sciences, PC: Program Core; PE: Program Electives, OE: Open Electives, Project, Int: Internships/Seminars, Other

Program Elective: V and VI

Program Elective	***Power System Track***	***Control, Automation and Drives Track***	***Renewable Energy & Electric Vehicle***	***Others***
V	Modern Electrical Grids EET472-6	Power Quality EET472-7	Advance Electrical Drives EET472-8	Industry Offered Elective-III EET472-9
VI	FACTS EET473-5	Industrial Electrical Systems EET473-2	Energy Storage & EV Charging Infrastructure EET473-6	Industry Offered Elective-IV EET473-7

Program Elective Tracks and list of courses

Sem	Program Elective No	Courses				
5	**I**	**Electromagnetic Fields EET354-5**	**Engg. Mechanics and Strength of Materials CET371**	**Biology for Engineers IDT351**	**Electrical Energy Conservation and Audit EET354-3**	**Industry Offered Elective-I EET354-4**
Sem	***Program Elective***	***Power System Track***	***Control, Automation and Drives Track***	***Renewable Energy & Electric Vehicle***	***Other***	
6	**II**	**Power Station Practice EET373-2**	**Electric Drives and Control EET373-5**	**Non-Conventional Energy Sources EET373-6**	**Utilization of Electrical Energy EET373-3**	**Industry Offered Elective-II EET373-4**
	III(T)	**Electrical M/C Design EET374-6**	**PLC and SCADA EET374-7**	**Photovoltaic System Engineering EET374-5**		
	III(L)	**Electrical Workshop EEP374-8**	**PLC and SCADA(L) EEP374-7**	**Photovoltaic System Engineering(L) EEP374-5**		
7	**IV(T)**	**High Voltage Engineering EE452-7**	**Digital Signal Processing EET452-8**	**IoT Applications for Energy EET452-9**	**----------**	
	IV(L)	**High Voltage Engineering(L) EEP452-7**	**Digital Signal Processing (L) EEP452-8**	**IoT Applications for Energy(L) EEP452-9**	**----------**	
8	**V**	**Modern Electrical Grids EET472-6**	**Power Quality EET452-7**	**Advance Electrical Drives EET472-8**	**Industry Offered Elective-III EET472-9**	
	VI	**FACTS EET473-5**	**Industrial Electrical Systems EET473-2**	**Energy Storage & EV Charging Infrastructure EET473-6**	**Industry Offered Elective-IV EET473-7**	

Honors in Distributed Energy Generation Systems

Scheme of Examination											
Sem	Course code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs)	Category
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total		
IV	EETH42	Renewable and Distributed Energy Sources	4	0	0	04	40	60	100	3	Honors
V	EETH52	Energy Storage System	4	0	0	04	40	60	100	3	Honors
VI	EETH62	Distributed Generation and Smart grids Or Equivalent SWAYAM NPTEL course approved by the Department	4	0	0	04	40	60	100	3	Honors
VII	EETH72	Design of Power Converter for Distributed Generation System Or Equivalent SWAYAM NPTEL course approved by the Department	4	0	0	04	40	60	100	3	Honors
VIII	EETH82	Power Quality Improvement Techniques Or Equivalent SWAYAM NPTEL course approved by the Department	4	0	0	04	40	60	100	3	Honors
TOTAL			20	00	00	20					

Minors in Electric Vehicles (EV)

Semester	Course code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs)	Category
			L	T	P		Continuous Evaluation	End Sem Exam	Total		
IV	EETM42	Basics of Electrical Engineering and EV	4	0	0	04	40	60	100	3	Minors
V	EETM52	EV Motors and their Control	4	0	0	04	40	60	100	3	Minors
VI	EETM62	EV Energy Management and Charging Infrastructure	4	0	0	04	40	60	100	3	Minors
VII	EETM72	EV Communication and Instrumentation	4	0	0	04	40	60	100	3	Minors
VIII	EETM82	EV Policies and Safety Aspects	4	0	0	04	40	60	100	3	Minors
TOTAL			20	00	00	20					

Open Elective

Scheme of Examination											
Sem	Course code	Course Name	Hours/week			Credits	Maximum Marks			ESE Duration (Hrs)	Category
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total		
IV	EET299-3	Elements of Electrical Technology	3	0	0	03	40	60	100	3	OE
	EET299-2	Renewable Energy Systems									
V	EET398-4	Electrical Appliances	3	0	0	03	40	60	100	3	OE
	EET398-5	Energy Storage Systems									
VI	EET399-1	Solar Photovoltaic Systems	3	0	0	03	40	60	100	3	OE
	EET399-2	Automation with PLC									
VII	EET498-1	Electric Vehicles	3	0	0	03	40	60	100	3	OE
	EET498-3	Energy Management and Audit									
TOTAL			12	00	00	12					

First Year Group1: Semester-I / Group2: Semester-II
Department of 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 bydriving 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 ingases, 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 |E|/|Hperp,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, Rayleighcriterion 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.

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical 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 drawvalid 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 experimentsbased 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.

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

Course Code: MAT151 **Course: 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 Calculusand 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 ofmathematics and applications that they would find useful in their disciplines.

Course Outcomes

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

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches ofengineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve Tracing , tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus

Module 1: Calculus: (7 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin's series expansions; Indeterminate forms and L'Hospital's rule; radius of curvature (Cartesian form), evolutes and involutes

Module 2: Multivariable Calculus (Differentiation) (8 hours)

Limit, continuity and partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 3 Calculus: (6 hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracingof curves (Cartesian form)

Module 4: Sequences and series: (7 hours)

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half rangesine and cosine series, Parseval's theorem.

Module 5: Multivariable Calculus (Integration) (7 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integrationin double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by double integration Center of mass and Gravity (constant and variable densities).

Module 6: Vector Calculus (7 hours)

Vector Differentiation, Directional derivatives, total derivative, Gradient, Curl and Divergence. Vector integration , Theorems of Green, Gauss and Stokes.

Topics for self learning

Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation(Tangent plane and Normal line) , Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

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).

First Year Group2: Semester-I / Group1: Semester-II

Department of Electrical Engineering

Course No. MAT152 **Course: Differential Equations, Linear Algebra,Statistics and 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 wouldbe 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 thebasic 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 variationof 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; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Topics for Self Learning

Application of Differential Equations.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, 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 and Problems of probability and statistics : 2nded :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.

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

Course Code: MAP151 **Course: Computational Mathematics LabL: 0**
Hr., T: 0 Hrs., P:2 Hrs., Per week **Total Credits : 1**

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principlesof mathematics relevant to the study of science and engineering. Students will show that they havelearnt 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 comparethe 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.

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

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

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

Course Outcomes

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

CO1: Understand and analyze basic ac and dc electric circuits and magnetic circuits

CO2: Understand working principles of electrical machines: Transformer, Induction motor, DC machinesCO3: Apply the knowledge of power converter for suitable applications

CO4: Introduce and identify the components of power systems and low-voltage electrical Installations.

Module 1: Introduction to Power system (2 hours)

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

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

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, BHcharacteristics, Basics of Magnetic circuits.

Module 3: Single Phase AC Circuits (6 hours)

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)

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)

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)

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)

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)

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.

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

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

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

Course Outcomes

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

CO1: Co-relate, analyze and apply the fundamental principles of science and engineering to understand the laboratory experimental work.

CO2: Connect the electric circuit, perform the experiment, analyze the observed data and make valid conclusion.

CO3: Write report based on the performed experiments (journal) with effective presentation of diagrams and characteristics/graphs.

CO4: Carry out survey of electrical energy consumption at home and calculate monthly energy bill as per the tariff of power Distribution Company.

List of Experiments

1. To verify Kirchhoff's laws for D.C. Circuits
2. Verification of Kirchhoff's laws to AC circuit(RLC series)
3. Verification of Kirchhoff's laws to AC circuit (RLC parallel).
4. To study speed control of D.C. shunts motor by:
   a) Armature voltage Control method.
   b) Field current/flux control method.
5. To study the balanced Three phase system for star and delta connected balanced load.
6. Improvement of power factor by using static capacitors
7. To determine regulation and efficiency of a single phase transformer by open circuit (o.c) and short circuit (s.c.) tests.
8. To determine regulation and efficiency of a single phase transformer by direct loading test

Demonstration / Study experiment

9. To study B-H curve for different magnetic material
10. To study Buck converter
11. To study Boost converter

Demonstration of cut out sections of machines:

i. DC Machine
ii. Three phase squirrel cage induction motor
iii. Synchronous machine

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

Course Code: MET151 **Course: Engineering Graphics and DesignL: 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. Floorplans 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) Narayana K. L. & P. Kannaiah (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.

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

Course Code: MEP151 **Course: Engineering Graphics and Design LabL: 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 toobjects, 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), drafting and design package, 3D printing.

List of sheets

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

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

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 Presidentof India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy& socialjustice
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

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

First Year Group1: Semester-I / Group2: Semester-II

Department of Electrical Engineering

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, theobjective 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 injuriesand 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

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical Engineering

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 andmolecular level modifications. Quantum theory is more than 100 years old and to understand differentphenomena; one has to base the description of all chemical processes at molecular levels.

The course will enable the student to:

- Rationalise periodic properties such as ionization potential, electro-negativity, oxidation states andelectron affinity.
- Analyse microscopic chemistry in terms of atomic and molecular orbitals and to apply this knowledge forunderstanding the band structure of different types of solids.
- Understand different types of molecular interactions, rationalise bulk properties and processes usingthermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levelsin various spectroscopic techniques
- List major chemical reactions that are used in the synthesis of molecules and to understand structuralaspect of organic compounds.
- Analyse impurities present in the water and suggest the methodology for its removal.

Chemistry (Concepts in Chemistry for Engineering)

(1) Periodic properties (6 Lectures)

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, Effective nuclear charge, atomic and ionic sizes, ionization energies, electron affinity, electronegativity, and polarizability, Fajan's rule, Hard soft acids and bases theory and its applications.

(2) Atomic and molecular structure (8 lectures)

Schroedinger equation. Particle in box solutions, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Equations for atomic and molecular orbitals. Molecular Orbital Theory and Molecular orbital diagrams of different homo-nuclear and hetero-nuclear diatomic molecules. Pi-molecular orbital diagram of butadiene and benzene.

Crystal field theory and the energy level diagrams for octahedral and tetrahedral complexes of transition metal ions and their magnetic properties.

Band structure of solids and the role of doping on band structures.

(3) Spectroscopic techniques and applications (8 lectures)

Electromagnetic Spectrum, Principles of spectroscopy.

Electronic spectroscopy – Basic Principles, Lambert-Beer's Law, Woodward-Fisher Rule for conjugated dienes.Fluorescence and its applications in medicine.

Nuclear magnetic resonance – Basic Principles, Chemical Shift, Spectral interpretation of some simplecompounds.

(4) Chemical Thermodynamics and Electrochemistry (8 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of real gases and critical phenomena. Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies.The Nernst equation and applications, Corrosion – Basic principle and mechanism of corrosion.

(5) Stereochemistry and Organic Reactions (8 lectures)

Stereoisomers, configurations and symmetry & chirality, enantiomers, diastereomers, optical activity. Introduction to reactions involving substitution, addition, elimination, oxidation, reduction. Synthesis of acommonly used drug molecule such as Ibuprofen, Aspirin, Paracetamol, Chloroquine, etc.

(6) Water Technology (6 lectures)

Impurities in natural water, hardness and alkalinity, Disadvantages of hardness i. e. sludge and scale formation, softening of water using lime-soda, zeolite and ion-exchange method, advantages and limitations of these water softening processes, Desalination of water using Reverse Osmosis.

Suggested Text Books

(i) A Textbook of Engineering Chemistry by Dr. Rajshree Khare, S. K. Kataria and Son's Publisher.

(ii) Selected topics in Inorganic Chemistry by W. U. Malik, R. D. Madan & G. D. Tuli, S. Chand Publications.

(iii) Engineering Chemistry by A. Pahari, B. Chauhan, Firewall Media, Infinity Science Press LLC.

(iv) A Textbook of Engineering Chemistry by S. S. Dara, S. Chand Publications.

(v) Applied Chemistry by V. K. Walekar, A. V. Bharati, Tech-Max Publications.

(vi) Organic Chemistry by R. L. Madan, Mc-Graw Hill Publications.

(vii) Elementary Organic Spectroscopy, Revised Edition by Y. R. Sharma, S. Chand Publications.

(viii) Organic Chemistry – Reactions and Reagents by O. P. Agrawal, Goel Publishing House Publications.

(ix) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Reference Books

(i) Physical Chemistry, by Robert G. Mortimer, Elsevier Academic Press Publications.

(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane, Mc-Graw Hill Publications.

(iii) Organic Chemistry by Paula Y. Bruice, Pearson India.

(iv) Physical Chemistry, Third Edition by Gilbert W. Castellan, Adison-Wesley Publishing company.

(v) Physical Chemistry, by P. W. Atkins, Oxford University Press Publications.

(vi) Chemical Principles, Eight Edition, Steven S. Zumdahl, Donald J. DeCoste, Cengage LearningPublications.

(vii) Chemistry – The Molecular Nature of Matter and Change, Fifth Edition by Martin S. Silberberg, Mc-GrawHill Publications.

(viii) Chemistry, An Introduction to Organic, Inorganic and Physical Chemistry, Third Edition by Catherine E.Housecroft, Edwin C. Constable, Pearson Prentice Hall Publications.

(ix) Organic Chemistry, Third Edition, William Kemp, Palgrave Publications.

(x) Concise Inorganic Chemistry, Fourth Edition by J. D. Lee, Chapman and Hall Publications.

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical Engineering

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 the amount of different impurities in water/waste water samples.
- Estimate rate constants of reactions and order of the reaction from concentration of reactants/products as a function of time and to validate adsorption isotherms.
- Measure molecular/system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
- Synthesize a polymer or drug molecule or nano-material.

List of Experiments for Chemistry Lab

1. Determination of Surface tension of a given liquid/mixture.
2. Determination of Viscosity of a given liquid/mixture.
3. Estimation of total, temporary and permanent hardness present in a given water sample.
4. Estimation of type and extent of alkalinities present in a given water sample.
5. Estimation of Cu and Zn in a brass sample.
6. Study of chemical oscillations or iodine clock reaction and determination of rate constant of the reaction.
7. Estimation of acid value of oil.
8. Estimation of saponification value of oil.
9. Ion Exchange column for removal of hardness.
10. Study of adsorption of acetic acid by charcoal.
11. Synthesis a polymer / drug molecule / nano-material.

Suggested Books/Reference Books

(1) A Textbook on Experiments and Calculations in Engineering Chemistry by S. S. Dara, S. Chand Publications.

(2) Advanced Practical Physical Chemistry by J. B. Yadav, Krishna's Prakashan Media (P) Limited.

(3) Collection of Interesting General Chemistry Experiments, A by A. J. Elias, Universities Press Publications.

(4) College Practical Chemistry by V. K. Ahluwalia, S. Dhingra and A. Gulati, Universities Press Publications.

(5) Advanced Practical Medicinal Chemistry by Ashutosh Kar, New Age International Publisher.

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical 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 Clanguage), 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 andsynthesize 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 ofcomplexity 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

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical 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 usingC programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical Engineering

Course Code: IDT151 **Course: Creativity Innovation and Design Thinking**
L: 1 Hrs., T: 0Hrs., P:0Hrs., Per week **Total Credits : 1**

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

Syllabus

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 andpuzzles, 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 andEvaluation: 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 ®, TradeSecret, 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

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical Engineering

Course Code: INT151 | **Course: Workshop / Manufacturing Practices**

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 metalcutting, fitting operations, and associated measuring and marking tools

Unit-2 Introduction to pattern making for metal casting, different types of carpentry tools, measuringtools 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. 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”4th Edition, Prentice Hall India 1998.

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical Engineering

Course Code: INP151 **Course: Workshop/ManufacturingPractices Lab**

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.

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical Engineering

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 wellas 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

4. Misplaced modifiers

3.1 Articles

3.2 Redundancies

3.3 Cliches

1. Nature and Style of sensible Writing

4.1 Describing

4.2 Defining

4.3 Classifying

4.4 Providing examples or evidence

2. Writing Practices

5.1 Comprehension

5.2 Precis Writing

5.3 Essay Writing

5.4 Letter Writing

5.5 Email Writing

3. 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

First Year Group 2: Semester-I / Group 1: Semester-II
Department of Electrical Engineering

Course Code: HUP151 **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

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

B. Tech III Semester

Department of Electrical Engineering

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

Course Outcomes

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

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

MODULE 1: [10Hours]

Laplace Transforms: Laplace transforms and their properties, Application for Laplace Transform tosolve ordinary differential equations including simultaneous Differential Equations. Solution of onedimensional Partial differential equations by Laplace Transform method.

MODULE 2: [8Hours]

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

MODULE 3: [8Hours]

Partial Differential equations: Partial differential equation of first order first degree i.e. Lagrange'sform. Linear homogeneous PDE of nth order with constant coefficient, method of separation of variables, Applications of partial differential equations.

MODULE 4: [8Hours]

Numerical Methods: Solution of algebraic and transcendental equations using method of false position and Newton-Raphson method. Solution of system of linear equations, Gauss elimination method, Gauss- Seidal method, .

Numerical solution of ordinary differential equations by Taylor's series method, Modified Euler's method, Runge-Kutta method.

MODULE 5: [8Hours]

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

Textbooks/References

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

B. Tech III Semester

Department of Electrical Engineering

Course Code: EET253 **Course: Data Structures and Algorithms**

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

Course Objectives

- To impart to students the basic concepts of data structures and algorithms.
- To familiarize students on different searching and sorting techniques.
- To prepare students to use linear (stacks, queues, linked lists) and non-linear (trees, graphs) data structures.
- To enable students to devise algorithms for solving real-world problems.

Course Outcomes:

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

CO1: Recognize different ADTs and their operations and specify their complexities.

CO2: Design and realize linear data structures (stacks, queues, linked lists) and analyze their computation complexity.

CO3: Devise different sorting (comparison based, divide-and-conquer, distributive, and tree-based) and searching (linear, binary) methods and analyze their time and space requirements.

CO4: Design traversal and path finding algorithms for Trees and Graphs

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Syllabus

MODULE– I: Data Structures and Algorithms Basics

Introduction: basic terminologies, elementary data organizations, data structure operations; abstract data types (ADT) and their characteristics.

Algorithms: definition, characteristics, analysis of an algorithm, asymptotic notations, time and space tradeoffs.

MODULE – II: Stacks and Queues

Array ADT: definition, operations and representations – row-major and column-major. Stack ADT: allowable operations, algorithms and their complexity analysis, applications of stacks – expression conversion and evaluation (algorithmic analysis), multiple stacks.

Queue ADT: allowable operations, algorithms and their complexity analysis for simple queue and circular queue, introduction to double-ended queues and priority queues.

MODULE – III: Linked Lists

Singly Linked Lists: representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc.

MODULE – IV: Sorting and Searching

Sorting: different approaches to sorting, properties of different sorting algorithms (insertion, Shell, quick, merge, heap, counting), performance analysis and comparison.

Searching: necessity of a robust search mechanism, searching linear lists (linear search, binary search) and complexity analysis of search methods.

MODULE – V: Trees

Trees: basic tree terminologies, binary tree and operations, binary search tree [BST] and

operations with time analysis of algorithms, threaded binary trees.

MODULE – VI: Graphs

Graphs: basic terminologies, representation of graphs, traversals (DFS, BFS) with complexity analysis, path finding (Dijkstra's SSSP, Floyd's APSP), and spanning tree (Prim's method) algorithms.

Text Books:

1. Ellis Horowitz, Sartaj Sahni& Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
2. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.
3. G.A.V. Pai; Data Structures and Algorithms: Concepts, Techniques and Application; First Edition; McGraw Hill; 2008.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein; Introduction to Algorithms; Third Edition; PHI Learning; 2009.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran; Fundamentals of Computer Algorithms; Second Edition; Universities Press; 2008.
3. A. K. Sharma; Data Structures using C, Second Edition, Pearson Education, 2013.

B. Tech III Semester

Department of Electrical Engineering

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

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

Course Outcomes:

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

CO1: Apply the basic Mathematical tools to circuit analysis.

CO2: Apply the frequency analysis to circuit with different input signals.

CO3: Find the various characteristics of networks & three phase power.

CO4: Apply the graphical approach to networks.

Course Objective:

To make Students able to apply different analytical tools on electrical networks for solving them.

Module-1: Equilibrium Equations: *[Minimum Teaching Hours:8 Hours]*
Equilibrium Equations with Nodal & Mesh Analysis on electrical networks, source transformations, Dot conventions in coupled circuits, Solutions of Mutually coupled Networks, Duality.
Three phase unbalanced circuits and power calculations.

Module-2: Network Theorems: *[Minimum Teaching Hours: 8 Hours]*
Superposition, Reciprocity, Thevenin's, Norton's. Maximum Power Transfer, Compensation, Tellegen's theorem as applied to DC & A.C. circuits.

Module-3: Laplace Transform & Applications*: [Minimum Teaching Hours: 10 Hours]*
Evaluation of initial & final condition, Concept of complex frequency, Partial fractions, Singularity functions, Waveforms Synthesis, Steady state and transient state analysis of RL, RC, RLC network with initial & final conditions using Laplace Transformation.

Module- 4: Network Functions: *[Minimum Teaching Hours: 7 Hours]*
Transient Response, Driving points and transfer functions, Poles, Zeros of network function, their properties, Time response from Pole-Zero locations on s-plane, convolution integral solution.

Module-5: Two Port Networks: *[Minimum Teaching Hours: 6 Hours]*
Network Parameters and Inter-connections, Conditions of Reciprocity and Symmetry, Inter-relations between parameter sets.

Module-6: Network Graph Theory & Resonance: *[Minimum Teaching Hours:7 Hours]*
Paths and Cycles, Connectivity, Trees, Spanning Sub-graphs, Random graphs. Formation of incidence Matrix, Cut-set Matrix, Tie-set Matrix,
Resonance in series & parallel RLC circuits.

Text Books:

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications,1998.
3. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education,2004.
5. A.Chakrabarty, “Circuit Theory (Analysis & Synthesis)”, Dhanpat Rai & Co. 2006

References:

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

B. Tech III Semester

Department of Electrical Engineering

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

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

Course Outcomes

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

CO1: Discuss the operation and analyze the characteristics of semiconductor diodes, BJT, and MOSFET.
CO2: Design and analyze electronic circuits containing non-linear elements such as diodes, MOSFET, & BJT using the concepts of biasing, load lines, operating point and incremental analysis.
CO3: Analyze inverting and non- inverting configurations of operational amplifier with negative feedback, evaluate performance parameters of operational amplifier.
CO4: Design Op-amp circuits for linear and nonlinear applications. ADC/DAC for designing electronic circuits for desired applications

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

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

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

MODULE 4: [07 Hours]
Feedback amplifier and Op-amp fundamentals: General Feedback amplifier Structure, Properties of Negative Feedback,: Characteristics of operational amplifier, open loop Op-amp, basic inverting and non- inverting Op-amp amplifiers with negative feedback, Op-amp parameters & their analysis.

MODULE 5: [10 Hours]
Op-amp linear and nonlinear applications: Voltage follower, summing amplifiers, integrators and differentiators, difference amplifiers & instrumentation amplifiers, Clipper, Clamper, Comparators, Schmitt trigger circuits, Sample/Hold circuits, Digital to analog converters, Analog to digital converters

MODULE 6: [06 Hours]
Oscillators and Active filters design: Precision rectifiers, oscillators: basic concept, Op-amp based sinusoidal oscillators, design of Active filters. .

Textbook

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

Reference books

1. Donald Neamen, “Electronic Circuits: Analysis and Design,” Third Edition, McGraw-Hill Publication, 2006.

2. Donald Neamen, “Semiconductor Physics and Devices: Basic Principles,” Fourth edition, McGraw-Hill, 2011.

3. Jacob Millman, Christos Halkias, Chetan Parikh, “Millman's Integrated Electronics,” Second edition, McGraw Hill Education, 2017.

4: Ramakant Gayakwad, ” OP-AMPS and linear integrated circuits” 4th Edition, PHI

5 D. Roy Choudhary, Shail Jain “Linear Integrated Circuits”, 4th Edition, New Age International.

B. Tech III Semester

Department of Electrical Engineering

Course Code: EET252 **Course: Electrical Measurements & Instrumentation**

L:3Hrs.,T: 1 Hrs., P:2 Hrs., Per week **Total Credits: 4**

Course Objective:

The objective of the course is to prepare the students to enable the development of skills through which the student will gain the knowledge of the basic principles of all measuring instruments and apply it for the measurement of electrical and non-electrical quantities.

Course Outcomes:

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

CO1. Identify suitable bridge for the measurement of passive electrical elements.

CO2. Discuss the operating principle and construction of different types of analog instruments.

CO3. Discuss the operating principle and construction of digital instruments for the measurement of electrical quantities

CO4. Discuss the Instrument transformers and calculate various operational parameters.

CO5: Select and compare different transducers for the measurement of various physical quantities.

Syllabus

Module-I (Teaching Hours – 9)
Measurement Systems**,** classification of different measuring Instruments, D.C bridges (Wheat stone, Kelvin and Kelvin's Double bridge) A.C bridges (Schering Bridge, Maxwell-Inductance- Capacitance Bridge, Hay's bridge, Owen's Bridge and DeSauty's Bridge),

Module-II (Teaching Hours – 9)
Analog Measurement Techniques, Principles of permanent magnet moving coil(PMMC) instrument, Moving iron (MI) instrument and Electrodynamometer type instruments. Measurement of three phase and single phase power , loading effect of instruments.

Module-III (Teaching Hours – 6)
Digital Measurement Techniques , True RMS measurement, measurement of voltage, Current, Power, Frequency and Energy.

Module-IV (Teaching Hours – 7)
Introduction to Instrument transformers and its applications.
Working principle of Special Instruments, Insulation Tester, Earth tester,

Module-V (Teaching Hours –9)
Classification of Transducers, -Electromechanical transducers, Potentiometric resistance Transducers, Inductive type transducers, Variable inductance transducer, , Piezoelectric transducer, Strain gauges, Linear variable differential transformer, Capacitive type transducer, resistance strain gauge, Digital transducers,

Module-VI (Teaching Hours –7)
Measurement of temperature, measurement of flow, measurement of motion and measurement of pressure.

Text books:

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

Reference Book :

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

B. Tech III Semester

Department of Electrical Engineering

Course Code: MBT251 **Course: Innovation and Entrepreneurship**

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

Course Outcomes:

After attending the course students should be able to:

1. Understand the logic and mechanics of a business enterprise
2. Develop an understanding of the entrepreneurial process from the conceptual stage to becoming an established business
3. Develop an understanding of business functions essential for the success of technology enterprises.
4. Develop a scalable, repeatable & profitable business model
5. Create Business Plan.
6. To use techniques and tools of innovation for bringing out innovation in products, services, and business.

Module I: Overview, Idea Generation / Evaluation: Startups and businesses, Types & stages of start-up, Idea generation strategies, Startup life cycle, Boot-strap financing, angels/VCs – elevator pitch, incubators and, business accelerators, entrepreneurs mindset, General environment Analysis for identifying opportunities.

Module II & III: Business model canvas: Components of business model and canvas, Value proposition and Differentiation, Customer Segmentation, Customer relationships, Channels, Key Partnerships, Key Activities, Key Resources, Revenue streams, Cost Structure, Value proposition and Differentiation,

Module IV: Customer Discovery: The need for Customer feedback, Product Market Fit, The Customer Discovery Process, Customer Discovery and Validation

Viable Product (MVP) & agile engineering: Definition of MVP, Planning an agile engineering team for quick change in business model (pivot), Start-up team & communication method,

Module V: Business Narrative and Go-ahead Decision Process: Developing the Business Narrative after Validating the BMC, The Go-Ahead Decision Process,
Business plan: Components of Business plan, Problem and Need, Scenario presentation, Sizing Market potential, TAS, Go-To-Market strategies, and Cost Modelling
Team and Technology: Ideal Team composition, Technology, and Solution

Module VI: Tools for Innovation and Business Plan: *Design Thinking, Competitor Analysis, Cash flow, and project financing*

Readings:

Textbook:

The Start-up Owner's Manual: The Step-by-Step Guide for Building a Great Company, by Steve Blank & Bob Dorf. (Available in Kindle also)

Reference Books:

1. The Art of War, Sun-Tzu (Sun Tzu: The Art of War... free epub book at http://www.epubbooks.com/book/692/the-art-of-war)
2. Hope is not a Strategy, Rick Page
3. Innovation and Entrepreneurship, Peter Drucker
4. Biographies of Andy Grove, Bill Gates, Larry Ellison, Googl Founders, etc
5. Straight from the Gut and Winning, Jack Welch
6. How to Drive Your Competition Crazy, Guy Kawasaki
7. Crossing the Chasm, Geoffrey Moore
8. Differentiate or Die, Jack Trout

B. Tech III Semester

Department of Electrical Engineering

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

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

Course Outcomes

On successful completion of the course, the students:

1. Will get sufficient knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual'soutlook, so as to perceive our environmentalissues 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 energyand processes.
5. Will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be adopted, to protect the environment from getting polluted.

Syllabus

Principle of contaminant behaviour and recent trends in environmental pollution controlI- 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, dyeingand 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 aerobicand anaerobic techniques, safe disposal.

Case studies

Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, andagro 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 ofgreen 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 programand Act- 2016, National river conservation plan, Formation of National Green Tribunal

Books Suggested

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

B. Tech IV Semester

Department of Electrical Engineering

Course Code: EET271 **Course: Signals and Systems**

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

Course Objectives

The objective of the course is to prepare the students to analyze the various signals in real life application in time domain and frequency domain. The course will prepare students to intermediate level of fluency with signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing

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Course Outcomes:

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

CO1: Classify different types of signals and systems.
CO2: Analyze the differential equations in time domain.
CO3: Apply Fourier transform to continuous-time and discrete-time signals
CO4: Apply z transform to discrete signals and systems
CO5: Illustrate the sampling process and its various applications

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Syllabus

Module-I: Introduction to signals and systems (Teaching Hours – 8)
Signals and systems as seen in everyday life, and in various branches of engineering and science. Different types and properties of signal and systems. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals.

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

Module-III: Fourier Transform (Teaching Hours - 10)
Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT), the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT).

Module-IV: **Z Transform** (Teaching Hours - 7)
The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis, various properties of z transforms.

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

Text Books:

1. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.AICTE Model Curriculum for Undergraduate degree in Electrical Engineering (Engineering & Technology)

Reference Books:

1. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
2. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

B. Tech IV Semester

Department of Electrical Engineering

Course Code: ENT260 **Course: Digital Circuits and Microprocessor**

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

Course Outcomes:

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

CO1: Discuss the working of various combinational circuits for different applications.

CO2: Identify the different sequential components used in combinational circuits.

CO3: Design and verify functionality of various combinational and sequential circuits.

CO4: Describe the architectural features of 8085 microprocessor and their usage.

CO5: Organize instructions to implement assembly language programs using 8085 microprocessor instruction set.

CO6: Comprehend and incorporate the concepts of Subroutines and Interrupts of 8085 microprocessor in simplifying assembly language programs.

Syllabus:

Module: 1 [06 Hours]

Logic Simplification: Number system, Binary Arithmetic, Boolean algebra and De Morgan's Theorem, Logic Gates, SOP & POS forms, Logic Optimization Technique, Karnaugh maps.

Module 2: [06 Hours]

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

Module 3: [09 Lectures]

Sequential Logic Design: Latches Flip flop – S-R, J-K, D, T and Master-Slave JK FF, Counters, Shift registers.

Module 4: [06 Hours]

Microprocessor Introduction: Introduction of Intel's 8085A: Architecture, description. Flag structure, concept of PSW, Addressing modes, Timing diagrams.

Module 5: [09 Hours]

Programming: Instruction Set Stack and Subroutine, Simple and Nested subroutines, Push-Pop, Call-Return instructions, Stack manipulation, (simple programming).

Module 6: [06 Hours]

Interrupts: Interrupt concept& structure in 8085, Interrupt Service Routines (ISR), advanced instructions of Programming of 8085A.

Text books:-

1. Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016.
2. Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009.
3. Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar, 5th Edition, Penram International Publications.

Reference books:-

1. Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.
2. Digital Electronic Principles, By Malvino PHI, 3 Edition.

B. Tech IV Semester

Department of Electrical Engineering

Course Code: EET272 **Course: Electrical Machines-I**
L: 3Hrs., T: 1 Hrs., P:0Hrs., Per week **Total Credits:4**

Course Objectives

The objective of the course is to acquire the practical knowledge of construction, working and operation of transformer, Induction Motor and DC machines and also introduce the procedure for testing of machines.

Course Outcomes

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

CO1: Discuss the construction, operation and speed control of DC Motor and analyse its performance.
CO2: Discuss the construction and operation of a Transformer and analyse the performance parameters.
CO3: Discuss the various ratings and connections of Three phase Transformer, it's parallel operation and calculate the load sharing.
CO4: Discuss the construction and operation of a Three Phase Induction Motor and evaluate it's performance.
CO5: Understand the concepts of starting, speed control and braking of three-phase induction motor and analyses the Torque-speed characteristics.
CO6: Discuss the construction, operation and characteristics of single-phase ac motors.

Module 1: DC Machines (08 Hours)

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

Module2: Transformer (08 Hours)

Brief review of single-phase transformer, construction of 3-phase transformer, classification of three phase transformer on the basis of core construction and winding, comparison between 3-phase transformer and a bank of three 1-phase transformers, Difference between power transformer and distribution transformer, OC & SC test on three phase transformers, calculation of regulation and efficiency, Accessories of oil immersed transformer (numerical excluded), introduction to dry type transformer, methods of cooling.
Auto-transformer: Construction, comparison with two winding transformers, VA conducted magnetically and electrically.

Module 3: Transformer (Cont…..) (08 Hours)

Calculation of all-day efficiency, Polarity test, various connections of 3-phase transformer with vector groups, clock notation of 3-phase transformer, three phase to two phase conversion (qualitative analysis), temperature rise test, concept of Inrush current, Tap changer (on load and off load).
Parallel operation of transformer: Conditions for parallel operation and load sharing between parallel connected transformer.

Module 4: Three phase Induction Machine (08 Hours)
Construction,3-phase winding, production of rotating magnetic field, slip, equivalent circuit, phasor diagram, torque equation, power flow, torque-slip characteristic in all three modes of operation (motor, generator and braking), No load and blocked rotor tests**,** Double cage Induction motor, calculation of equivalent circuit parameters, losses and efficiency.

Module 5: Starting, speed control and braking of 3-phase Induction Motor (08 Hours)
Starting methods of 3-phase Induction Motor: DOL starting, Rotor Resistor starting, Auto-transformer starting, Star-Delta starting.
Speed control Methods: By change in input voltage, input frequency, V/F method, rotor resistance control and consequent pole changing technique. Effect of change in input voltage, input frequency, both with constant V/F ratio and rotor resistance on torque-slip characteristics.
Braking methods: Plugging, Regenerative braking, DC and AC braking.

Module 6: Single phase AC Motors (08 Hours)
Single Phase induction motor, Double revolving field theory and development of equivalent circuit. Methods of starting using auxiliary winding, capacitor start-run type, capacitor start induction run type, applications.
Introduction to universal motor and shaded pole motor: constructional features and performance characteristics, application.

Text Books:
1. Electrical Machines: Dr. P.S. Bimbhra
2. Electrical Machines: Ashfaq Hussain
3. A Text Book of Electrical Technology: B. L. Theraja (Vol. II)
4. Electric Power Transformer Engineering by Charles W. Johnson,3rd Edition,2012 CRC Press

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

B. Tech IV Semester

Department of Electrical Engineering

Course Code: EET276 **Course: Power System-I**
L: 3 Hrs, T: 0 Hr, P: 0 Hrs. Per week **Total Credits: 03**

Course Objectives
To familiarize students with basic structure of Power System and introduce them to different electrical and mechanical aspects related to Power System transmission and distribution.

Course outcomes
After the completion of the course, the students will be able to

CO1: Discuss Per Unit System and calculate various components of power system.

CO2: Calculate different electrical parameters of transmission line.

CO3: Model different types of transmission line and determine their performance

CO4: Explain and analyse different types of distribution system and underground cables.

CO5: Discuss and analyse mechanical aspects of transmission system.

Syllabus

Module-I (Teaching Hours - 6)
Basic Concepts: – Evolution of Power Systems and Present-Day Scenario. Structure of a power system, Transmission and Distribution Systems, Single line diagram, overhead and underground system, AC and DC transmission, Introduction to per-unit system and per-unit calculations.

Module- II (Teaching Hours - 8)
Transmission Line Parameters: - Transmission line parameters, Electric and Magnetic Fields around conductors, Capacitance and Inductance calculations for symmetrical and unsymmetrical conductor spacing, Transposition of line, Skin and Proximity effect, bundled conductors, Corona.

Module- III (Teaching Hours - 10)
Performance of Transmission Line: - Sinusoidal Steady state representation of Lines: Short, medium and long lines. Performance of transmission line and voltage regulation, Real and reactive power flow in transmission line, Surge Impedance Loading.

Module- IV (Teaching Hours - 8)
Distribution System and Cables: - Types of distribution system and its topologies, Feeders, distributors and service mains, Quantitative analysis of DC and AC distributor. Types of Cables, Capacitance of single-phase and three-phase Cable, Grading of Cable.

Module- V (Teaching Hours - 8)
Mechanical Design of Transmission Line: - Line Supports, Types of towers, Sag Calculation, Effect of Wind and Ice loading, Insulators: Types, Voltage distribution in insulator string, improvement of string efficiency.

Text Books:

1. Electric Power Systems: *C.L.Wadhwa, Wiley Eastern Ltd, New Delhi.*
2. Modern Power System Analysis: *D. P. Kothari and I. J. Nagrath, McGraw Hill Education, 2003.*
3. Principles of Power System: *V.K.Mehta, S.Chand ,2005*

Reference Books:

1. Power System Analysis: *J. Grainger and W. D. Stevenson, McGraw Hill Education,1994.*
2. Electric Energy Systems Theory: *O. I. Elgerd, McGraw Hill Education, 1995.*
3. Power System Analysis: *R. Bergen and V. Vittal, Pearson Education Inc., 1999.*
4. Electric Power Systems: *M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, Wiley, 2012.*

B. Tech IV Semester

Department of Electrical Engineering

Course Code: EET277 **Course: Object Oriented Programming**

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

Course Objectives

The objective of the course is to prepare the students:

1. To enable the development of skills through which the student will gain expertise in writing programs using object oriented programming features.
2. Learn to apply concepts of File handling, exception handling.
3. To develop various programs on Generics, Collections and multithreading

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Course Outcomes

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

CO1: Discuss and analysis of different features object oriented programming.

CO2: Develop basic programs for given problems.

CO3: Discuss the File handling and exception handling and develop programs using concept Of error handling

CO4: Discuss Generics, Collections and multithreading and develop programs using these concepts.

Syllabus

Module-I (Teaching Hours – 7)

Features of Object Oriented Programming languages like data encapsulation, inheritance, polymorphism and late binding. Introduction to class and Methods, Access control of members of a class, instantiating a class, Constructors, Garbage Collection, finalize() Method.

Module-II (Teaching Hours – 7)

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism. Abstract classes and methods, interface, implementation of interface, creating packages, importing packages, static and non-static members.

Module-III (Teaching Hours - 8)

Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, Generics, generic class with two type parameter, bounded generics, Collection classes: Arrays, Vectors, Array list, Linked list, Hash set, Queues, Trees.

Module-IV (Teaching Hours - 8)

Introduction to streams, byte streams, character streams, file handling in Java, Serialization Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, Inter-thread communications.

Text Books:

1. JAVA The Complete Reference*: Herbert Schildt;*; Seventh Edition, Tata McGraw- Hill Publishing Company Limited 2007.

2. A programmer's Guide to Java SCJP Certification: A Comprehensive Primer: *Khalid A. Mughal and Rolf W.Rasmussen,* Third Edition.
3. Java Fundamentals: A Comprehensive Introduction:*HerbertSchildt and Dale Skrien*; Tata McGraw- Hill Education Private Ltd., 2013.

Reference Books:

1. Core JAVA Volume-II Advanced Features: *Cay S. Horstmann and Gary Cornell;* Eighth Edition; Prentice Hall, Sun Microsystems Press, 2008.
2. Java Programming: A Practical Approach: *C Xavier;* Tata McGraw- Hill Education Private Ltd., 2011.

B. Tech IV Semester

Department of Electrical Engineering

Course Code: EET299-3 **Course: Elements of Electrical Technology**
L: 3Hrs., T: 0 Hrs., P:0 Hrs., Per week **Total Credits: 3**

Course Outcomes:

After the complication of the course, the students will be able to

CO1: Discuss the various power generation sources.
CO2: Analyze the basic ac and dc electric circuits
CO3: Apply the basic mathematical tools for circuit analysis.
CO4: Classify various types of switchgear unit as per applications.
CO5: Understand tariff tables and use for electricity bill calculations.

Syllabus

Module I: Introduction to Power Generation: (Teaching Hours- 6)
Introduction to Thermal, Nuclear, Solar, Wind, Hydro and Bio mass based power generation
Introduction to Transmission & Distribution through different voltage levels using single line diagram.

Module II: Introduction to Electric Circuits (Teaching Hours-8)
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with DC excitation. AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Three phase AC generation, Power factor improvement.

Module III: Basics of Network Analysis (Teaching Hours-8)
Introduction to mesh and Nodal Analysis to electrical circuits, Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer

Module IV: Electrical Installation and Safety (Teaching Hours-8)
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing.
Illumination system Simple numerical to determine number of lamps to attain a given average lux level in an area.

Module V: Tariff (Teaching Hours-8)
Objectives of Tariffs, General tariff for, flat demand rate, straight meter rate, block meter rate, two part tariff, power factor dependent tariff, KVA based tariff, three part tariff, spot (time differentiated) pricing. Elementary calculations for energy consumption.

.**Text Books:**

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. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Reference Books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
3. Electrical Technology: B. L. Thereja, S. Chand Publications.
4. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013.
5. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.
6. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi,2015.
7. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, McGraw Hill, 2015.

B. Tech IV Semester

Department of Electrical Engineering

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

Course Outcomes:
1. Understanding renewable energy sources.
2. Gain knowledge of working principle of various solar energy systems.
3. Gain knowledge of working of wind power system.
4. Capability to work with energy systems like Hydel, Tidal, Biomass, Geothermal, Wave, Ocean.

MODULE-I : (05 Hrs)
Global and National Energy Scenario: Over view of conventional & renewable energy sources, need, potential & development of renewable energy sources, Global and Indian Energy scenario, Energy for sustainable development, Global climate change.

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

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

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

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

MODULE- VI: (05 Hrs)
Wave & Ocean Energy
Wave power – Basics Technology – Kinetic energy equation.
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

Text Books
1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH,New Delhi, 3rd Edition.
2. Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition,

2013.
3. Non-Conventional Energy Sources /G.D. Rai, Khanna Publishers

Reference Books

1. Renewable Energy- Edited by Godfrey Boyle-oxford University, press, 3rd edition, 2013.
2. Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific,Si'pore.
3. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
4. Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI.
5. Non-conventional energy source –B.H. Khan- TMH-2nd edition.

B. Tech IV Semester

Department of Electrical Engineering

Honours in Distributed Energy Generation Systems

Course Code: EETH42 **Course: Renewable and Distributed Energy Sources**

L: 4 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 04**

Course Outcomes

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

CO1: Discuss about renewable and non-renewable sources of energy
CO2: Discuss about the power generation using solar photovoltaic system.
CO3: Discuss about the wind energy and wind energy conversion system.
CO4: Discuss about the different renewable energy sources like hydel, Tidal, Biomass, Geothermal and Ocean energy
CO5: Discuss about the concept of distributed generation.

Module 1: Introduction (4 Hours)

Conventional power generation: advantages and disadvantages, Energy crises, Non - conventional energy (NCE) resources, Potential and scope

Module 2: Solar Photovoltaic System (10 Hours)

Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar-Electrical Power Generation, general Solar Photo Voltaic (SVP) system, Different configurations, SPV system components and their characteristics, Stand-Alone and Grid Connected SPV systems, other Miscellaneous Applications of Solar Energy.

Module 3: Wind Energy: (10 Hours)

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

Module 4: Hydel-Power: (08 Hours)

Water power estimates, use of hydrographs, hydraulic turbine, characteristics and part load performance, design of wheels, draft tubes and penstocks, plant layouts,

Module 5: Other Energy Sources (06 Hours)
Brief idea of other sources viz., tidal, geothermal, gas-based, etc,

.

Module 6: Introduction to Distributed Generation (06 Hours)

Concept of distributed generations, topologies, selection of sources, Advantages, issues in DG implementations. Requirements of hybrid/combined use of different renewable and distributed sources, need of energy storage

Texts/References Books:

Text Books:

1. Solar Photovoltaics Fundamentals, Technologies and Applications by Chetan Sing Solanki, Eastern Economy Edition : Third Edition.
2. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers
3. Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition, 2013.

Reference Books:

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

B. Tech IV Semester

Department of Electrical Engineering

Minors in Electric Vehicles

Course Code: EETM42 **Course: Basics of Electrical Engineering and EV**
L: 4 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits: 04**

Course Objectives

The objective of this course is to make the students familiar with basic ac and dc circuits, motors, architecture of electric and hybrid electric vehicles, vehicle dynamics, various topologies used in electric and hybrid electric vehicles.

Course Outcomes

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

CO1: Analyze the basics of ac and dc circuits.
CO2: Discuss the construction and operation of transformer, induction motor and DC Motor.
CO3: Compare electric vehicle with conventional vehicle and its impact on energy supplies.
CO4: Discuss the dynamics of vehicle.
CO5: Discuss the architecture and various topologies of EV and HEVs.

Syllabus

Module 1– Introduction to Electric Circuits (8 hours)
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with DC excitation, Basics of Magnetic circuits.

Module–II Single Phase AC Circuits (8 hours)
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits.

Module–III Introduction to Electric Machines (8 hours)
Construction and working principle of transformer, induction motor and DC motor.

Module–IV Overview of Electric Vehicle (06)
History of modern transportation, environmental impact and need of EV, comparison with IC engine, general layout of EV and its component, Electric vehicle Market, impact of modern drive trains on energy supplies.

Module–V Vehicle Dynamics (10)
Introduction, tractive efforts: linear and angular acceleration, aerodynamic drag, rolling resistance and uphill resistance. Power and torque to accelerate, dynamic equation, drive cycle and energy used.

Module–IV Drive train of EV and HEVs (08)
Basic concept of EVs and HEVs, classification, various drive-train topologies and power flow control.

Text Books:

1. Electrical Technology: B. L. Theraja, S. Chand Publications.
2. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Electric Circuits" James W. Nilsson, Susan Riedel, 9th edition, Prentice hall, 2011
5. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and
5. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals," CRC Press, 2021
6. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, 2003.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
3. Electric and Hybrid Vehicles: T. Denton, Routledge, 2016
4. Ali Emadi, "Handbook of Automotive Power Electronics and Drives", CRC publishers, 2012.