MAHATMA GANDHI MISSION`S JAWAHARLAL NEHRU ENGINEERING COLLEGE AURANGABAD.

DEPARTMENT OF ELECTRICAL ENGINEERING

Curriculum for

B.Tech. in ELECTRICAL ENGINEERING

w.e.f.

Academic Year

2020-21

Vision Statement of Institute

To create self-reliant, continuous learner and competent technocrats imbued with human values.

Mission Statements of Institute

1. Imparting quality technical education to the students through participative teaching –learning process.
2. Developing competence amongst the students through academic learning and practical experimentation.
3. Inculcating social mindset and human values amongst the students.

Vision Statement of Department

To Develop competent Electrical Engineers with human values.

Mission Statement of Department

1. To Provide Quality Technical Education to the Students Through Effective Teaching-Learning Process.
2. To Develop Student's Competency through Academic Learning, Practical's And Skill Development Programs.
3. To Encourage Students for Social Activities and Develop Professional Attitude Along With Ethical Values.

Program Educational Objectives (PEOs)

1. To equip the engineers of tomorrow to cope up with the fast-paced field of Electrical Engineering.
2. To update the students with the latest cutting-edge technologies by organizing talks, seminars and workshops.
3. To reinforce the importance of team work in students by undertaking minor and major projects.
4. To inculcate an attitude of commitment to quality among students.

Program Specific Objectives (PSOs)

At the end of the program, the student

PSO 1: Should able to apply the knowledge gained during the course of the program from Applied Science and all electrical courses in particular to identify, formulate and solve real life electrical problems faced in industries and research work.
PSO 2: Should able to provide socially acceptable technical solutions to complex electrical engineering problems with the application of modern and appropriate techniques for sustainable development.
PSO 3: Should able to provide electrical services in power system design and development of efficient drives.

Programme Outcomes (POs)

PO No.	Program Outcome Description
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design / Development of solution: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigation of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	The engineer & society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment & sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual & team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management & finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Lifelong 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.

SEMESTER-WISE STRUCTURE OF CURRICULUM

FIRST YEAR

Semester I

Course code	Course Title	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit
					Internal			External		Total	Internal			External		Total	
		L	T	P	CA	MSE	Total Int	ESE	PR		CA	MSE	Total int	ESE	PR		
20UCC101B	Engineering Mathematics I	3	2		20	20	40	60	-	100			16	24	-	40	5
20UCC102B	Engineering Chemistry	3	1		20	20	40	60	-	100			16	24	-	40	4
20UCC103B	Engineering Mechanics	3	1		20	20	40	60		100			16	24		40	4
20UCC104B	Electrical Technology	3	1		20	20	40	60	-	100			16	24	-	40	4
20UCC105C	Communication Skills	2	0		20	20	40	60		100			16	24		40	2
20UCC106B	Energy and Environmental Engineering	2	0		50		50			50			20			20	Audit
20UCC107L	Workshop Practices	0	0	2	30		30		20	50			12		8	20	1
20UCC108L	Communication Skills Lab	0	0	2	30		30		20	50			12		8	20	1
20UCC109L	Engineering Chemistry Lab	0	0	2	30		30		20	50			12		8	20	1
20UCC110L	Engineering Mechanics Lab	0	0	2	30		30		20	50			12		8	20	1
20UCC111L	Electrical Technology Lab	0	0	2	30		30		20	50			12		8	20	1
	Total	16	5	10	300	100	400	300	100	800			160	120	40	320	24

Semester II

Course code	Course Title	Teaching Scheme			Evaluation Scheme						Minimum Passing						Credit
					Internal			External		Total	Internal			External		Total	
		L	T	P	CA	MSE	Tot int	ESE	PR		CA	MSE	Total int	ESE	PR		
20UCC201B	Engineering Mathematics-II	3	2		20	20	40	60		100			16	24		40	5
20UCC202B	Engineering Physics	3	1		20	20	40	60		100			16	24		40	4
20UCC203B	Engineering Graphics	2			20	20	40	60		100			16	24		40	2
20UCC204B	Computer Programming and Problem Solving	2			20	20	40	60		100			16	24		40	2
20UCC205B	Basic of Civil and Mechanical engineering	2			50	-	50			50			20			20	Audit
20UCC206H	Universal Human Values	2			50	-	50			50			20			20	2
20UCC207L	Engineering Physics Lab			2	30		30		20	50			12		8	20	1
20UCC208L	Engineering Graphics Lab			4	30		30		20	50			12		8	20	2
20UCC209L	Computer Programming and Problem Solving Lab			2	30		30		20	50			12		8	20	1
20UCC210L	Universal human values Lab	0	0	2	30		30		20	50			12		8	20	1
20UCC210P	Engineering Exploration	0	0	4	60		60		40	100			24		16	40	2
	Total	14	3	14	360	80	440	240	120	800			176	96	48	320	22

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work.

SECOND YEAR

Semester III																		
Course code*	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**						**Minimum Passing**						**Credit**
					Internal			**External**		Total	**Internal**			**External**		Total	
(Mandatory)		L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE	PR		
20UEE301D	Engineering Mathematics III	3	1	0	20	20	-	60	-	100	8	8	-	24	-	40	4
20UEE302D	Electronic Devices and Circuits	3	0	0	20	20	-	60	-	100	8	8	-	24	-	40	3
20UEE303D	Network Analysis	3	0	0	20	20		60	0	100	8	8		24		40	3
20UEE304D	DC Machines	3	0	0	20	20		60	-	100	8	8		24	-	40	3
20UEE305D	Electrical Power Generation	3	0	0	20	20		60		100	8	8		24		40	3
20UEE306L	Electronic Devices and Circuits Lab	0	0	2		0	60		40	100			24		16	40	1
20UEE307L	Network Analysis Lab	0	0	2		0	60		40	100			24		16	40	1
20UEE308L	D.C. Machines Lab	0	0	2		0	60		40	100			24		16	40	1
20UEE309H	Gandhian Thoughts	1	0	0		0	0	50	0	50				20		20	1
20UEE310P	Mini Project	0	0	2		0	50	0	0	50			20				1
	Total	16	1	8	100	100	230	350	120	900							21

Semester IV																		
Course code*	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**						**Minimum Passing**						**Credit**
					Internal			**External**		Total	**Internal**			**External**		Total	
		L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE	PR		
20UEE401D	Electrical Power Transmission and Distribution	3	0	0	20	20		60		100	8	8		24		40	3
20UEE402D	Electrical Measurement and Instrumentation	3	0	0	20	20		60		100	8	8		24		40	3
20UEE403D	A.C. Machines	3	1	0	20	20		60		100	8	8		24		40	4
20UEE404D	Digital Electronics and Microprocessors	3	0	0	20	20		60		100	8	8		24		40	3
20UEE405E 20UEE406E	Electives 1. Analog and Digital Communication 2. Electrical Estimation and Costing	2	0	0	20	20		60		100	8	8		24		40	2
20UEE407H	Rural Transformation	1	0	0	-	-		50		50				20		20	1
20UEE408L	Electrical Measurement and Instrumentation Lab	0	0	2		-	60		40	100			24		16	40	1
20UEE409L	A.C. Machines Lab	0	0	2		-	60		40	100			24		16	40	1
20UEE410L	Digital Electronics and Microprocessors Lab	0	0	2		-	60		40	100			24		16	40	1
20UEE411L	Product Design Engineering	0	0	2		-	30		20	50			12		8	20	1
20UEE412L	Electrical Workshop	0	0	2		-	30		20	50			12		8	20	1
	Total	15	1	10	100	100	240	350	160	950							21

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work.

THIRD YEAR

Semester V																		
Course code*	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**						**Minimum Passing**							**Credit**
					Internal			**External**		Total	**Internal**			**External**		Total	
(Mandatory)		L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	T W	ESE	P R		
20UEE501D	Power System Analysis	3	1	0	20	20	-	60	-	100	8	8	-	24	-	40	4
20UEE502D	Control System Engineering	3	0	0	20	20	-	60	-	100	8	8	-	24	-	40	3
20UEE503D	Microcontroller and Applications	3	0	0	20	20	0	60	0	100	8	8		24		40	3
20UEE504E 20UEE505E 20UEE506E 20UEE507E	Electives 1. Power Plant Engineering 2. Electrical Materials 3. Analog and Integrated Circuits 4. Open Elective	2	0		20	20		60		100	8	8		24		40	2
20UEE508H	Engineering Economics	2	0	0	0	0		60		60				24		24	2
20UEE509C	Foreign Language	1	0	0	0	0		50		50				20		20	1
20UEE510L	Power System Analysis lab	0	0	2		0	60		40	100							
20UEE511L	Control System Lab	0	0	2		0	60		40	100			24		16	40	1
20UEE512L	Microcontroller and Applications Lab	0	0	2		0	60		40	100			24		16	40	1
20UEE513L	Computer Programming and Simulation Lab	0	0	2		0	60		40	100			24		16	20	1
20UEE514I	Industrial Internship (2 weeks)	N A	NA	NA			30		20	50			12		8	20	1
	Total	14	1	8	80	80	270	350	180	960							19

Semester VI																		
Course code*	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**						**Minimum Passing**							**Credit**
					Internal			**External**		Total	**Internal**			**External**		Total	
		L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	T W	ESE	P R		
20UEE601D	Power Electronics	3	1	0	20	20		60		100	8	8		24		40	4
20UEE602D	Electromagnetic Engineering	3	0	0	20	20		60		100	8	8		24		40	3
20UEE603D	Electrical Machine Design	3	0	0	20	20		60		100	8	8		24		40	3
20UEE604E 20UEE605E 20UEE606E 20UEE607E	Electives 1. Energy Conservation and Auditing 2. Industrial Management 3.Computer Networks 4. Open Elective	2	0	0	20	20		60		100	8	8		24		40	2
20UEE608D	Industrial Automation	3	0		20	20		60		100	8	8		24		40	3
20UEE609H	Constitutional Literacy	1	0		0	0		50		50	0	0		20		20	1
20UEE610L	Power Electronics Lab	0	0	2		0	60		40	100		0	24	16	16	40	1
20UEE611L	Electrical Machine Design Lab	0	0	2		0	60		40	100		0	24	16	16	40	1
20UEE612L	Industrial Automation Lab	0	0	2		0	60		40	100		0	16	24	24	40	1
20UEE613P	Project Part -I	0	0	2	0	-			60	60	0	0			24	24	1
	Total	15	1	8	100	100	180	350	180	910							20

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work.

FOURTH YEAR

Semester VII																		
Course code	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**						**Minimum Passing**							**Credit**
					Internal			**External**		Total	**Internal**			**External**		Total	
		L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE	PR		
20UEE701D	Electrical Drives	3	0	0	20	20	-	60	-	100	8	8	-	24	-	40	3
20UEE702D	Switchgear and Protection	3	0	0	20	20	-	60	-	100	8	8	-	24	-	40	3
20UEE703D	Digital Signal Processing	3	0	0	20	20	0	60	0	100	8	8		24		40	3
20UEE704D	High Voltage Engineering	3	0	0	20	20	0	60	-	100	8	8		24	-	40	3
20UEE705E 20UEE706E 20UEE707E	Electives 1. FACTs 2. Embedded System 3. Software for Electrical Engineering	3 1	0 2	0	20	20	0	60		100	8	8		24		40	3
20UEE708H	Life Skills	1	0	0	0	0		50		50	0	0		20		20	1
20UEE709L	Electrical Drives Lab	0	0	2		0	60		40	100		0	24		16	40	1
20UEE710L	Switchgear and Protection Lab	0	0	2		0	60		40	100		0	24		16	40	1
20UEE711L	Digital Signal Processing Lab	0	0	2		0	60		40	100		0	24		16	40	1
20UEE712L	High Voltage Engineering Lab	0		2		0	60		40	100		0	24		16	40	1
20UEE713L 20UEE714L	Elective Lab 1. FACTs 2. Embedded System	0	0	2		0	60		40	100		0	24		16	40	1
20UEE715P	Project –Part II	0		4		0	60		40	100			24		16	40	2
	Total	16/14		14	100	100	360	350	240	1150							23

Semester VIII																		
Course code*	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**						**Minimum Passing**							**Credit**
					Internal			**External**		Total	**Internal**			**External**		Total	
Complete any two courses in Emerging areas of Electrical Engineering (NPTEL) on line courses		L	T	P	CA	MSE	TW	ESE	PR		CA	MSE	TW	ESE	PR		
20UEE801M	Electrical Power Quality	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
20UEE802M	Electrical and Hybrid Vehicles	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
20UEE803M	Power System Dynamics and Control	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
20UEE804M	Internet of Things	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
20UEE805M	Mechatronics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
20UEE806M	Robotics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
20UEE807I	Industrial Internship (6 Months)	NA	NA	NA	NA	NA	**100**	NA	**150**	NA	NA	NA	**40**	NA	**60**	100	10
	Total						**100**		**150**	**250**			**40**		**60**		16

L- Lecture, T-Tutorial, P-Practical, CA- Continuous Assessment, MSE- Mid Semester Examination, ESE- End Semester Examination, PR-Practical, TW-Term Work.

DETAILED 4-YEAR CURRICULUM CONTENTS

Undergraduate Degree in Engineering & Technology

Program: Electrical Engineering

Total Credits (Four Year Course) – 160

SEMESTER III

Course Code : 20UEE301D	***Engineering Mathematics III***	***Total credits: 04***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory: 03Hrs/week		***Mid sem: 20Marks***
Tutorial: 01Hr/week		***End-Semester : 60 Marks***

Course Objectives	1.To develop Logical understanding of the subject. 2. To develop mathematical skill so that students are able to apply mathematical methods & Principle's insolving problems from Engineering fields. 3.To produce graduates with mathematical knowledge & computational skill.
Course Outcomes	At the end of the syllabus, 1. Student will able to apply concept of rank of matrix to examine consistency of homogeneous and non-homogeneous system of liner equations. 2. Student will able to apply concept of Laplace transform and Laplace transform of elementary functions. 3. Student will able to apply knowledge of Laplace transform and inverse Laplace transform to solve IVP . 4. Student will able to explain the concept of Fourier transform and Fourier integral. 5. Student will able to differnce equations using Z-transform.
Pre-requisites	Pre-university mathematics and calculus.
Course Type	***Basic Science course***
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1: Linear Algebra- Matrices							
Inverse of a matrix by Gauss-Jordan method; Rank of a matrix; Normal form of a matrix; Consistency of non- homogeneous and homogeneous system of linear equations; Eigen values and eigen vectors; Properties of eigen values and eigen vectors (without proofs); Cayley Hamilton's theorem (without proof) and its applications.	***CO 1***	***1,2***	***PSO1***	***1.1***	***1.1.4***	***Lecture***	
Unit 2: Laplace transform							
Definition, transforms of elementary functions, Properties & theorems of Laplace transforms (without proof), transforms of periodic function, Heaviside unit step function, displaced unit step function, Dirac delta function, error function, Bessel' function of zero order.	***CO 2***	***1,2***	***PSO1***	***1.1***	***1.1.5***	***Lecture***	
Unit 3: Inverse Laplace transform and its applications:							
Inverse Laplace transforms by using i) properties, ii) partial fractions, iii)	***CO 3***	***1,2***	***PSO1***	***1.1***	***1.1.5***	***Lecture***	

Convolution theorem, Application to solve linear differential equations with constant coefficients (Initial value problems), Simultaneous Linear differential equations .							
Unit 4: Fourier Transform:							
Fourier Transform, Fourier sine and cosine transform, Fourier integral, **Fourier** sine and cosine integral.	***CO 4***	***1,2***	***PSO1***	***1.1***	***1.1.5***	***Lecture***	
Unit 5: Z Transform:							
Definition, Z transform of elementary functions, properties of Z transform, Inverse Z transform, Solution of difference equation by Z transform.	***CO 5***	***1***	***PSO1***	***1.1***	***1.1.5***	***Lecture***	

Text Books :

1.P.N.Wartikar and J. N. Wartikar, *A Text Book of Engineering Mathematics* (Volume-I, II,III), Pune Vidyarthi Griha Prakashan, Pune.
2.B. S. Grewal, "*Higher Engineering Mathematics*," Khanna Publications, New Delhi
3.H.K. Das, "*Advanced Engineering Mathematics*," S. Chand & Company.

Reference Books :

1.B.V. Ramana, "*Higher Engineering Mathematics* ," (Tata McGraw-Hill).
2.Erwin Kreyszig, "*Advanced Engineering Mathematics*," Wiley Eastern Ltd.
3.Ravish R Singh, Mukul Bhat, "*Engineering Mathematics A Tutorial Approach*," by,Mc Graw Hill

E-Resources :

1. NPTEL course

Course Code : 20UEE302D	***ELECTRONIC DEVICES & CIRCUITS***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory : 03 Hrs/week		***Mid sem: 20Marks***
Tutorial: -Hr/week		***End-Semester : 60 Marks***

Course Objectives	1. To state features of various semiconductor diodes. 2. To review the working principles of various transistors. 3. To review the working various electronic circuits.
Course Outcomes	At the end of course, students will be able to 1. plot & examine characterestics of various semiconductor diodes. 2. quantify the performance characterestics of various transistors. 3. design & verify waveshaping circuits. 4. design & verify amplifiers & oscillators. 5. verify op-amp IC 741 configurations.
Pre-requisites	Electrical Technology
Course Type	Engineering Professional course
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
UNIT 1: Diodes							
*"*Review of semoconductors, PN junction diodes, biasing , diffusion & deplelation layer capacitance, V-I characterestics of diode, Zener diode, Tunnel diode, Varactor diode, schottky diode, LED, LCD, Photodiode.	***CO1***	***PO1,2,12***	***PSO 1***	***1.6***	***1.6.1***	***ICT TOOLS***	
UNIT 2: Transistors							
*"*Introduction to BJT, operation of CB,CE,CC configutrations of BJT, Characterestics of CB, CE & CC configurations, base width modulation, Thermal runaway & heat sink, Types of FET, opearation & characterestics of FET, JFET parameters, Types of MOSFET , working & characterestics of MOSFETs, comparisionm between BJT, FET & MOSFET	***CO2***	***PO1,2,12***	***PSO 1***	***2.7***	***2.7.1***	***ICT TOOLS***	
UNIT 3: Waveshaping Circuits							
*"*Series & shunt diode based clipper & clampers, Voltage	***CO1, 3***	***PO1,2,12***	***PSO 1***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	

multipliers, Half & full Rectifiers with and without filters.*"*							
UNIT 4: Amplifiers							
*"*BJT biasing & stabilization, BJT as amplifier, Classification of amplifiers, Voltage Amplifiers, Multistage amplifiers, Power amplifiers, Feedback amplifiers, FET amplifiers*"*	***CO1, 4***	***PO1,2,3, 12***	***PSO 1 &2***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	
UNIT 5: Oscillators							
Barkhausen criterion, stability with feedback. Classification of oscillators, RC Oscillators: FET RC Phase Shift oscillator, Wein bridge oscillator, LC Oscillators: Hartley and Colpitts oscillators, Crystal oscillators, UJT Relaxation oscillator, IC 555, Monostable & astable operation of IC 555*"*	***CO1***	***PO1,2,12***	***PSO 1 &2***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	
NIT 6: Introduction to Integated Circuits							
Introduction, Operational overview, Differential amplifier configurations, Op-amp supply voltages, IC Identification, op-amp packages, Operational amplifiers, Block diagram of op-amp IC 741, , Inverting & Non-inverting configutaions of op-amp.*"*	***CO1***	***PO1,2,12***	***PSO 1***	***1.6***	***1.6.1***	***ICT TOOLS***	

Text Books :

1. R. S. Sedha, Applied Electronics, S. Chand publication New Delhi , 2009.
2. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9thEdition, Prentice Hall of India, 2006.
3. Brijesh Iyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", Synergy Knowledgeware Mumbai, 2017. ISBN:9789383352616

Reference Books :

1.Albert Malvno & David J. Bates, Electronic principles, 7th edition, Tata Mc-graw Hill publication.
2 Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000
3. Donald Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill.
4. David A. Bell, "Electronic Devices and Circuits",5th Edition, Oxford Press

E-Resources :

1. Semiconductor Devices online course on www.coursera.org
2. Analog Electronic Circuits NPTEL online course by IITKGP.

Course Code : 20UEE303D	***Network Analysis***	***Total credits: 04***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory : 03 Hrs/week		***Mid sem: 20Marks***
Tutorial: -Hr/week		***End-Semester : 60 Marks***

Course Objectives	1. To develop an understanding of the fundamental laws and elements of electric circuits. 2. To learn the energy properties of electric elements 3. To understand waveforms, signals, and transient, and steady-state responses of RLC circuits.
Course Outcomes	1. To be able to understand basic electrical properties 2. To be able to analyze electrical circuits 3. To be able to analyze circuit response using Laplace transform 4. To be able to apply Fourier transform to analyze signals. 5. To be able to apply circuit analysis to DC and AC circuits.
Pre-requisites	Basic terms regarding Voltage, Potential Difference, Current, Resistance, Ohm's Law, Resistance Calculation, basics of KVL & KCL.
Course Type	***1 – Program Core Course***
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1 : Basic Concepts							
Resistance, Resistivity, Impedance Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. Graph Theory: Directed, Undirected, Planar, Non-Planer, Subgraph, Connected graph, Degree of vertex, tree & co-tree, incident matrix, tie set, cut set.	***CO1 CO2***	***PO1 PO2***	***PSO1***	***1.2 1.5 2.5***	***1.2.1 1.5.1 2.5.1 2.5.3***	***Interactive teaching with the help of ICT***	
Unit 2 : Network Theorems (DC & AC)							
Superposition, Reciprocity, Millman's theorems, Thevinin's and Norton's theorems, Maximum Power transfer theorem and Millers Theorem.	***CO2 CO5***	***PO1 PO2***	***PSO1***	***1.2 1.5 2.6***	***1.2.1 1.5.1 2.6.1***	***Interactive teaching with the help of ICT***	
Unit 3 : Transient Analysis							
Charging & Discharging of capacitor & Inductor, Behaviour of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.	***CO3 CO5***	***PO1 PO2 PO4***	***PSO1 PSO2***	***1.2 1.5 4.4***	***1.2.2 1.5.3 4.4.3***	***Interactive teaching with the help of ICT***	

Unit 4 : Two Port Network							
Two port parameters, short circuit admittance parameter, open circuit impedance parameters, Transmission parameters, Image parameters and Hybrid parameters. Ideal two port devices, ideal transformer. Tee and Pie circuit representation, Cascade and Parallel Connections.	***CO5*** ***CO2***	***PO1*** ***PO2***	***PSO1***	***1.2*** ***1.5*** ***2.6***	***1.2.1*** ***1.5.1*** ***2.6.1***	***Interactive teaching with the help of ICT***	
Unit 5: Laplace Transformation & Application							
Solution of networks, step, ramp and impulse responses, waveform Synthesis, Laplace transform of singular & shifted function,	***CO3*** ***CO5***	***PO1*** ***PO2*** ***PO4***		***1.2*** ***1.5*** ***2.6*** ***4.5***	***1.2.1*** ***1.5.1*** ***2.6.1*** ***4.5.1***	***Interactive teaching with the help of ICT***	
Unit 6: Fourier Transform & Application							
Periodic and non-periodic signals. Impulse function. Ramp function.Triangular function. Peak value. Average value. Effective value (RMS). Sinusoidal andco-sinusoidal signals. Euler's expression. Generic harmonic signal. Amplitude and phase.	***CO4***	***PO1*** ***PO2*** ***PO5***	***PSO1***	***1.2*** ***1.5*** ***2.6*** ***5.5***	***1.2.1*** ***1.5.1*** ***2.6.1*** ***5.5.4***	***Interactive teaching with the help of ICT***	

Text Books :

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. M E Van Valkenburg, "Network Analysis",Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
3. Ravish Singh "Network Analysis and Synthesis" ,McGraw-Hill Education, 2013

Reference Books :

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013..
3. J. W. Nilsson and S. Riedel," Electric Circuits", Pearson-Prentice Hall,2013.

E-Resources :

1. ***https://nptel.ac.in › courses***
2. ***https://ocw.mit.edu › courses***

Course Code : 20UEE304D	***D.C. Machines***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory : 03Hrs/week		***Mid sem: 20Marks***
Tutorial: -Hr/week		***End-Semester : 60 Marks***

Course Objectives	1.To know and understand working principles of D.C. Machines and Special Machines. 2. To understand different tests on the D.C. Machines 3. To know various characteristics of the D.C. Machines.
Course Outcomes	Students will 1. know the analogy between electric and magnetic circuits. 2. understand the operation of dc machines. 3. be able to analyse the differences in operation of different dc machine configurations. 4.know various special machines and their operation. 5.understand use of D.C. motors for traction.
Pre-requisites	*Basic Electrical Engineering*
Course Type	*Program Core Course*
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1 Principles of Electromechanical Energy Conversion							
Review of Magnetic Circuits Electromagnetic force and torque B-H curve of magnetic materials; flux-linkage vs. current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element.	***CO1***	***PO1, PO2***	***PSO1, PSO2,***	***1.2 2.2***	***1.2.1 2.2.2***	***Interactive Teaching, Explanation, chalk and Talk***	
Unit 2. DC Generators:							
Construction of armature and field systems, Working, types, EMF equation, Armature windings, Characteristics and applications, building of EMF, Armature reaction - Demagnetizing and Cross magnetizing MMFs and their estimation; Remedies to	***CO2***	***PO1, PO2 PO 3***	***PSO1, PSO 2, PSO 3***	***1.3 2.2 3.1***	***1.3.1 2.2.2 3.1.1***	***Interactive Teaching, Explanation, Chalk and Talk***	

overcome the armature reaction; Commutation process, Causes of bad commutation and remedies.							
Unit3 D.C. Motors:							
Principles of working, Significance of back EMF, Torque Equation, Types, Characteristics and Selection of DC Motors, Starting of DC Motors, Speed Control, Losses and Efficiency, Condition for Maximum Efficiency, Braking of DC Motors, Effect of saturation and armature reaction on losses; Applications,)	***CO2***	***PO1 PO2 PO3***	***PSO 1, PSO 2, PSO 3***	***1.3 2.2 3.1***	***1.3.1 2.2.2 3.1.1***	***Problem Based Learning***	
Unit 4 Testing of D. C. Machines:							
Load test, Brake test, Swinburne's test, Hopkinson's test on D.C. Machines, Calculation of Losses, Numerical	***CO3***	***PO1 PO2 PO3***	***PSO 1 PSO 2 PSO 3***	***1.3 2.2 3.1***	***1.3.1 2.2.2 3.1.1***	***Explanation, Numerical***	
Unit 5 Introduction to Special Machines:,							
Universal Motors, Reluctance Motor, Hysteresis Motor, D.C. Servo Motor, PMDC motor, BLDC motor, Servo motor (Only Elementary Aspects	***CO4***	***PO1, PO 2***	***PSO 1, PSO 2***	***1.3 2.2***	***1.3.1 2.2.2***	***Chalk and Talk***	
Unit 6 Applications of D.C. Motor							
Traction Motors- Tractive effort and horse power , speed control scheme, Electric braking, Use of D.C. motor in conveyors	***CO5***	***PO1 PO2***	***PSO 1 PSO 2***	***1.3 2.2***	***1.3.1 2.2.2***		

Text Books :

1. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata Mc Graw Hill Publication, 4th Edition 2010, Reprint 2012.
2. A. E. Fitzgerald, C. Kingsley, S. D. Umans, "Electrical Machinery", Tata Mc Graw Hill, 2002, (6th edition).

Reference Books :

1. Nasser Syed, "Electrical Machines and Transformers", A New York, Macmillon 1984.
2.Langsdorf A. S., "Principles of DC Machines", 6th Edition, Mac Graw Hill Book Company 1959.
3. Bhag S. Guru and Huseyin R. Hiziroglu, "Electric Machinery and Transformers", Third Indian edition, Oxford University Press, Reprint 2014.

E-Resources :

1. 1. NPTEL Lectures

Course Code: 20UEE305D	Course Title	Total credits: 03
Teaching Scheme	Electrical Power Generation	Evaluation Scheme
Theory : 03 Hrs/week		CA: 20 Marks
Tutorial : 00 Hrs/week		Mid Sem: 20 Marks
Practical : 00 Hrs/week		End Sem: 60 Marks

Course Objective	1. To introduce students to different aspects of power plant engineering. 2. To familiarize the students to the working of power plants based on different fuels. 3. To learn development of hydropower plant , hydroelectric power plant, nuclear power plant, diesel power plant, gas turbine power plant, solar power plant, wind power plant as well as its performance parameter/characteristics 4. To learn other energy sources like: Biomass, tidal and wave energy etc
Course Outcomes	Student will be able to 1. Impart the knowledge of generation of electricity based on conventional and nonconventional energy sources 2. Identify the major electrical equipment in power station 3. Do the analysis of different types of power plants and its design 4. Gain ability to plot the power /Energy demand in the form of graph.
Pre-requisites	Electrical Technology
Course Type	Program Core Course
Course Contents	

Unit No.	Co Mapping	PO Mapping	PSO Mapping	Competency	PI	Teaching Methodology	Remark
Unit 1 : Introduction *(07Hrs)*							
a. Sources of Electrical Power Wind, solar, fuel cell, tidal, geo-thermal, hydro-electric, thermal-steam, diesel, gas, nuclear power plants (block diagram approach only). Concept of co-generation. Combined heat and power distributed generation. b. Economic aspects and tariffs in power Generation: Terms commonly used in system operation, various factors affecting cost of generation: Load curves, load duration curves, Connected load, maximum load, Peak load, base load and peak load power plants, load factor, Plant capacity factor, Plant use factor, Demand factor, diversity factor, Cost of power plant, Tariffs	CO1,CO4	**PO1,PO2**	**PSO1**	1.1 1.2 1.3 2.1	1.1.2 1.2.1 1.3.1 2.1.3	Interactive classroom teaching (ICT) classroom teaching	
Unit 2 : Thermal power plant, Nuclear power plant *(07Hrs)*							
a. Thermal power plant Main parts, Schematic arrangement, advantages and disadvantages, site	CO2,CO3	**PO1,PO2,PO3**	**PSO1,PSO3**	1.1 1.2 1.3 2.1	1.1.2 1.2.1 1.3.1 2.1.3	ICT, classroom teaching	

selection, Environmental aspects for selecting the sites and locations of thermal power stations., b. Nuclear power plant Schematic arrangement, advantages and disadvantages, selection of site, nuclear reactors and its components , Safety of nuclear power reactor, Environmental aspects for selecting the sites and locations of nuclear power stations.				3.1	3.1.1		
Unit 3: Hydro power plant *(06Hrs)*							
Schematic arrangement, advantages and disadvantages, selection of site, constituents of hydro power plant, Hydro turbine, Environmental aspects for selecting the sites and locations of hydro power stations	CO2,CO 3	***P03,PO7***	***PSO1,PS O3***	3.1 7.1 7.2	3.1.1 7.1.2 7.2.2	ICT, classroom teaching	
Unit 4: Diesel power plant and Gas turbine power plant *(06Hrs)*							
a. Diesel power plant Introduction, Schematic arrangement, advantages and disadvantages, Choice and characteristic of diesel engines, auxiliaries. b. Gas turbine power plant: Schematic arrangement, advantages and disadvantages of Gas turbine power plant. Open cycle and Closed cycle gas turbine power plant, Combined cycle power plant, Comparison of various power plants	CO2,CO 3	***PO1,PO 2,PO3***	***PSO1,PS O3***	1.1 1.2 1.3 2.1 3.1	1.1.2 1.2.1 1.3.1 2.1.3 3.1.1	ICT, classroom teaching	
Unit 5: Solar Power Plant *(06Hrs)*							
Solar power generation system, components of solar power plant, solar cell, module, array , types of solar power plant, types of solar plate collector and its applications, site selection, shadow analysis, selection of PV module technology and sizing, Connection of PV Module (series and parallel), plant installation	CO2,CO 3	***PO1.PO 2***	***PSO1,PS O3***	1.1 1.2 1.3 2.1	1.1.2 1.2.1 1.3.1 2.1.3	ICT, classroom teaching	
Unit 6: Wind Power Plant and other energy sources *(7Hrs)*							
Wind Power Conversion System, Introduction to wind energy, basic principles of wind energy conversion, Basic components of wind energy conversion systems, advantages, disadvantages, selection of site Other Energy Sources:	CO2,CO 3	***P03,PO7***	***PSO1,PS O3***	3.1 7.1 7.2	3.1.1 7.1.2 7.2.2		

Biomass - various resources, energy contents, conversion of energy, Biomass fired boilers, Problems in harnessing Tidal and wave energy - schemes, reliability, Geothermal and Ocean thermal energy conversion (OTEC) systems, Fuel Cell Technology							

Text Books:

1. Principles of power system by.V.K.Mehta, Rohit Mehta
2. Electrical Power, Dr. S.L. Uppal
3. A course in electrical power by J.B.Gupta
4. Power system engineering by A.C. Chakrabarti, Soni-Gupta-Bhatnagar

Reference Books:

1. Nag. P. K. Power Plant Engineering, McGraw Hill, New Delhi, ISBN: 978-9339204044
2. Gupta, B.R., Generation of Electrical Energy, S. Chand& Co. New Delhi,
3. Soni, Gupta, Bhatnagar, A Course in Electrical Power. – Dhanpatrai and Sons 11. System, S.Chand & Co. New Delhi, 2005, ISBN: 9788121924962

E-sources:

1. NPTEL course on “Power Generation”
2. Online course on Electrical power system https://www.classcentral.com/course/electric-power-systems

Course Code: 20UEE306L	ELECTRONIC DEVICES & CIRCUITS LAB	Total credits :01
Execution Scheme		Evaluation Scheme
Practical : 02 Hrs/week		CA- 40 Marks End sem – 40 Marks

Lab outcomes	Students will be able to 1. identify & handle various electronic componenets. 2. verify characterestics of transistors. 3. verify different amplifiers on kit. 4. verify different oscillators on kit. 5. verify op-amp IC on kit.

Course Contents

Sr	Name Of Practical	Type/ Methodology	LO Mappping	PO Mapping	PSO Mapping	Compe-tency	PI
1.	1. To verify V-I characterstics of diode.	Performance	LO1	PO1,2	PSO1	1.6	1.6.1
2.	2. To verify Zener diode as voltage regulator	Performance	LO1	PO1,2	PSO1,	1.6	1.6.1
3.	3. To verify input & output characterestics of BJT.	Performance	LO2	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
4.	4. To verify input & output characterestics of FET.	Performance	LO2	PO1,2	PSO1,2,	1.6 2.7	1.6.1 2.7.1
5.	5. To verify Enhancement & Deplation mode of MOSFET.	Performance	LO2	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
6.	6. To verify frequency response of Multistage amplifiers.	Performance	LO3	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
7.	7. To verify Class A, B, AB & C power amplifiers.	Performance	LO3	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
8.	8. To verify RC oscillator.	Performance	LO4	PO1,2	PSO1,2,	1.6 2.7	1.6.1 2.7.1
9.	9. To verify LC oscillators.	Performance	LO4	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
10.	10. To verify inverting Configuration of op-ap IC 741.	Performance	LO5	PO1	PSO1,	1.6	1.6.1

Course Code: 20UEE307L	Network Analysis LAB	Total credits :01
Execution Scheme	Computer Lab / Electrical Workshop	Evaluation Scheme
Practical : 02 Hrs/week		CA- 40 Marks End sem – 40 Marks

Lab outcomes	1. Verifies principles of network mathematically. 2. Able to simulate the Electrical Circuits in simulation software 3. Able to build and verify network theorems practically. 4. To be able to make models of electrical circuits in Laplace domain. 5. To be able to analyze signal responses.

Course Contents

Sr	Name Of Practical	Type/ Methodology	LO Mappping	PO Mapping	PSO Mapping	Compe-tency	PI
11.	Verification of KCL & KVL.	Performance	LO1	PO2,3	PSO1,2,3	2.7 3.7	2.7.1 3.7.1
12.	Verification of Loop Analysis & Nodal Analysis	Performance	LO2 LO3	PO2,3	PSO1,2,3	2.7 3.7	2.7.1 3.7.1
13.	Verification of Superposition Theorem	Performance	LO3 LO4	PO2,3	PSO1,2,3	2.7 3.7	2.7.1 3.7.1
14.	Verification of Thevinion's theorem	Performance	LO4 LO5	PO2,3	PSO1,2,3	2.7 3.7	2.7.1 3.7.1
15.	Verification of Norton's theorem	Performance	LO2 LO5	PO4,5	PSO1,2,3	4.6 5.6	4.6.1 5.6.1
16.	Verification of maximum power transfer theorem	Performance	LO3 LO5	PO4,5	PSO1,2,3	4.6 5.6	4.6.1 5.6.1
17.	Verification of reciprocating theorem	Performance	LO4 LO5	PO4,5	PSO1,2,3	4.6 5.6	4.6.1 5.6.1
18.	Simulation & Analysis of Charging & Discharging of Capacitor and Inductor	Performance	LO2 LO4	PO4,5	PSO1,2,3	4.6 5.6	4.6.1 5.6.1
19.	Determination of transient response of current in RL, RC & RLC circuits with step voltage input	Performance	LO4 LO5	PO4,5	PSO1,2,3	4.6 5.6	4.6.1 5.6.1
20.	Determination of transient response of current in RLC circuit with step voltage input for under damped, critically damped and over damped cases	Performance	LO4 LO5	PO4,5	PSO1,2,3	4.6 5.6	4.6.1 5.6.1

Course Code : 20UEE308L	***D.C. Machines Lab***	***Total credits: 01***
Execution Scheme		***Evaluation Scheme***
Practical Hrs: 2Hrs/week		***CA : 60Marks***
		End-Semester Exam : 40 Marks

Lab Outcomes	1.Students will be able to conduct various tests on the machines 2.Students will be able to obtain different characteristics of machines 3. Students will be able to find efficiency and regulation of Machines

Course Contents

Name of the Practical	*CO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Teaching Methodology*	*Remark*
1.B-H Curve of D.C. Motor	*LO1*	*PO1, PO2*	*PSO1*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	
2.Load Test on D.C. Series Generator.	*LO1, LO2*	*PO1, PO2*	*PSO1, PSO2*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	
3.Determination of magnetization, external and internal characteristics of a DC shunt generator	*LO1, LO2*	*PO1, PO2*	*PSO1, PSO2*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	
4.Load Test on D.C Compound Generator	*LO1, LO2*	*PO1, PO2*	*PSO1, PSO2*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	
5.Determination of efficiency of a DC shunt or compound generator at various loading conditions.	*LO3*	*PO1, PO2*	*PSO1, PSO2*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	
6.Speed control of a separately DC Shunt motor by- (i) armature voltage control and (ii) Field current control method	*LO2*	*PO1, PO2*	*PSO1, PSO2*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	
7.Brake Test on D.C. Shunt motor.	*LO2, LO3*	*PO1, PO2*	*PSO1, PSO2*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	
8. Direct load test on DC shunt motor to obtain it's on load Efficiency.	*LO3*	*PO1, PO2*	*PSO1, PSO2*	*1.3 2.2*	*1.3.1 2.2.2*	*Performance*	

Reference Books :

1.Laboratory Manual for Electrical Machines, 1/e D.P. Kothari & B.S. Umre

Course Code : 20UEE309H	*Gandhian Thoughts*	*Total credits: 01*
Teaching Scheme		*Evaluation Scheme*
		CA : Marks
Theory : 02Hrs/week		*Mid sem: -*
Tutorial: -Hr/week		*End-Semester : 50Marks*

Course Objectives	1. To discuss significance of Gandhian philosophy in present social scenario. 2. To realize importance of Gandhian thoughts in delivering social justice. 3. To understand power of non-violence and its impact on civilization.
Course Outcomes	1. Student would be able to realize significance of gandhinan thought. 2. Student would be able to explain social justice delivered through gandhian philosophy. 3. Student would learn self discipline and its impact. 4. Student would be able to realize power of swedeshi movement and its impact. 5. Student would realize power and necessity of religious harmony.
Pre-requisites	-
Course Type	Humanities & Social Sciences

Course Contents

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1 : Basic Concepts							
Introduction to Gandhian Thought. The early 20th century political scenario in India and World (with special reference to Great Britain, South Africa	**CO1**	**PO6** **PO8**	**PS03**	***6.1*** ***8.1***	***6.1.1*** ***8.1.1***	**Discussion**	
Unit 2 : Social Justice							
NON-Violence techniques (Conflict Resolution, Social Justice and Reform, Self Rule, Nation Building. Influences on Gandhiji's Thought. Impact of Gandhian Thought on the Constitution of India 3.6 VinobaBhave and Bhoodan Movement	**CO2**	**PO6** **PO9**	**PS03**	***6.1*** ***9.1***	***6.1.2*** ***9.1.2***	**Discussion**	
Unit 3 : culture							
Influence of the Oriental Culture. Impact of the Western thought. Influence of different religions.	**CO3**	**PO6** **PO8**	**PS03**	***6.1*** ***8.1***	***6.1.3*** ***8.1.3***	**Discussion**	

Fundamental Concepts in Gandhian Thought. Sadhya-sadhanShuchita, Ahimsa , Satya							
Unit 4: Social Transformation							
.Gandhiji's Thoughts on Social Transformation Religious Harmony Removal of Untouchability Women's Emancipation	**CO4**	**PO6 PO12**	**PS03**	***6.2 12.2***	***6.2.1 12.2. 1***	**Discussion**	
Unit 5: Gnadhihi vision of Education							
Gandhiji's Thoughts on Education. The Purpose and Meaning of Education Functions of a Teacher . Basic Education and Knowledge(NayiTalim) . Political Thought of Gandhiji. Nationalism	**CO5**	**PO6**	**PS03**	***6.2.***	***6.2.1***	**Discussion**	

Text Books :

1. Bhave, Vinoba. SwarajSastra. Akhil Bharat Sarva-Seva-Sangh Pub., 1955.
2. Dalton, Dennis. Mahatma Gandhi: Nonviolent power in action. Columbia University Press, 2012.
3. Fischer, Louis. The essential Gandhi: his life, work, and ideas: an anthology. Random House Inc, 1962.

Reference Books :

1-Fox, Richard Gabriel. Gandhian utopia: Experiments with culture. Boston, MA: Beacon Press, 1989.

2. Gangal, Anurag. "The Gandhian concept of Human security and peace." 2007.

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E-Resources :

1. https://www.gandhiashramsevagram.org/gandhi-resources/gandhi-resource-persons.php
2. ***. http://library.mgu.ac.in/e-resources/***

Course Code: 20UEE310P	***Mini Project***	***Total credits: 01***
Execution Scheme		***Evaluation Scheme***
Practical Hrs: 2Hrs/week		***CA: 50Marks***
		End-Semester Exam : -

Lab Outcomes	Students will be able to 1.Build and verify basic scientific principles. 2.document the work done.

Course Contents

Name of Practical	*LO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Type/Methodology*	*Remark*
1. Study various resources and components in electrical engineering projects To study different Electrical Symbols.	***LO 1***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Study and Observation***	
2. Study datasheet of basic circuit components of a project	***LO1***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
3. Study various software in building of project like: Electric Circuit, X-Circuit, Electrician app, Electronic Tutorials, Logisim, Circuit simulator.	***LO1***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
4.Preparation of PCB for a given project.	***LO1***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Design and Performance***	
5.Verification and analysis of project.	***LO1***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
6. Report writing	***LO1, LO2***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Writing***	

SEMESTER IV

Course Code:20UEE401D	***Electrical Power Transmission and Distribution***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
Theory : 3Hrs/week		***CA : 20 Marks***
Tutorial: --Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks
Course Objectives	1-To understand the structure and operation of power system and appreciate its role in our Society 2-To acquire and analyze the knowledge of transmission line parameters and their influence on the operation of transmission line. 3- 4-To interpret the different distribution systems, substations, overhead lines and underground cable	
Course Outcomes	Students will be able to - 1-Outline the structure and operation of power system and appreciate its role in our Society 2-Infer the significance of different parameters and its influence on the operation of transmission line. 3-Asses the performance of transmission line and identify different phenomena that effects transmission line performance 4-Asses and compare various distribution systems and substations 5-Appraise the concepts, advantages and practical applications of underground cables	
Pre-requisites	Basic Electrical Engineering, Network Analysis	
Course Type	***Program Core Course***	
Course Contents		

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	****Teaching Methodology***	***Remark***
Unit 1: Supply Systems							
Electric supply system, Typical AC power supply Scheme, Comparison of DC and AC transmission, Advantages of high transmission voltage, Various system of power transmission, Comparison of conductor material in overhead system, Comparison of conductor material in underground system, Comparison of various systems of transmission, Elements of a transmission line, Economics of power transmission, Economical choice of conductor size, Economic choice of transmission voltage, Requirement of satisfactory electric supply	***CO1***	***PO11***	***PSO1***	***11.1 11.2***	***11.1.1 11.1.2 11.2.1***	***Classroom Teaching***	
Unit 2: Over head lines and Cables							

General structure of electrical power system; power transmission & voltage levels; power distribution through overhead lines. single line diagram, Main components of over head lines, Conductor materials, Line supports, insulators, Types of insulators, Potential distribution over suspension insulators, String efficiency, Methods of improving string efficiency, Sag in over head lines and sag calculations Underground cables, Construction of cables, Classification of cables, Cables for three phase services, Insulation resistance of a single core cable, Capacitance of a single core cable, Dielectric stresses in a single core cable, Most economical conductor size in a cable, Grading of cables, Capacitance grading and inter sheath grading, Capacitance of three core cable and measurement of capacitance	***CO5***	***PO1PO3***	***PSO1 PSO 2***	***1.1 3.1***	***1.1.1 3.1.1 3.1.2***	***Smart Room Teaching, Brain Storming***	
Unit 3: Transmission Lines							
Inductance and capacitance of single-phase, three-phase single circuit and double circuit lines, concept of GMD, transposition of lines, effect of earth on capacitance of transmission lines, Kelvin's law, Voltage, current and power calculations	***CO2 CO3***	***PO1PO3***	***PSO1***	***1.3 3.1***	***1.3.1 3.1.1***	***Smart Room Teaching, Group Assignment and Discussion***	
Unit 4: Transmission Lines (Contd.)							
Characteristics and performance of transmission lines, transmission lines as four terminal networks, nominal-T, nominal-π, equivalent-T, and equivalent- π representation of transmission lines, A, B, C, D constants, distributed parameters of long lines, hyperbolic solutions, Ferranti effect, surge impedance loadings.	***CO2 CO3CO!***	***PO1PO3***	***PSO1 PSO3***	***1.3 3.1***	***1.3.1 3.1.2***	***Smart Room Teaching, Brain Storming***	
Unit 5: DC and AC Distribution							
Distribution system, classification of Distribution systems, AC distribution, DC distribution, Connection scheme of distribution system, Types of DC distributors, DC distribution calculations, DC distributor fed at one end, uniformly	***CO4***	***PO1PO5***	***PSO1 PSO2***	***1.3 5.2***	***1.3.1 5.2.1***	***Peer to Peer, Team Exercise***	

loaded distributor fed at one end, distributor fed at both ends, Distributor with both concentrated and uniform loading, Ring distributor, Ring main distributors with interconnector, AC distribution calculations, Methods of solving AC distribution problems, 3-phase unbalanced loads – 4 wire, Star connected unbalanced loads, Ground detectors.							
Unit 6: Distribution Substation							
Types of substations, Location of substation, Equipment and accessories of substation. Layout of substation, Earthing of substation. Distribution systems, feeder and distributor, radial, loop & grid system, primary feeder conductor size, Computation of voltage drop, Transmission & distribution losses	***CO4***	***PO2 PO3PO4***	***PSO2***	***2.2 3.2 4.1***	***2.2.2 3.2.1 3.2.2 4.1.1***	***Emphasis of Practical Learning***	

Text Books:

1. "Elements of Power Systems", Stevenson, 4th Edition
2. "Power System Engineering", Nagrath Kothari, TMH Pbs.

Reference Books:

1. "A Course In Electrical Power", Soni, Gupta and Bhatnagar, Dhanpat Rai.
2. "Electrical Power Systems", Ashfaq Hussain, CBS Pbs.
3. "Electrical power systems", C. L. Wadhwa, New Age Pbs.
4. "Substation Design and Control" by Gupta & Satnam
5. Electric Power distribution system Engineering, 2nd Edition, T. Gonen, CRC Press

E-sources:

1. NPTEL course on "Electrical Power System"
2. https://pe.gatech.edu/courses/power-transmission-and-distribution

Activity:

A Substation Visit to 132kV/ 66kV or HV Transmission Substation of 765kV

Course Code : 20UEE402D		***Total credits -03***
Teaching Scheme	***Electrical Measurement and Instrumentation***	***Evaluation Scheme***
Theory : 4 Hrs/week		***CA: 20 marks***
Tutorial: Hr/week		***Midsem:20 marks***
		End sem: 60 marks

Course Objectives	1. Introduction to Knowledge of science, mathematics, and engineering parameter measurement principles. 2. Ability to apply this knowledge of science, mathematics, and engineering parameter measurement principles for solving problems. 3. Ability to utilize and apply the various devices for measurement of various parameters.
Course Outcomes	***Students will be able to*** 1. Identify various basic movement systems used in parameter measurement. 2. Gain proficiency in the use of shunts and multipliers and calibration of energy meters and watt meters. 3. Solve the problems for measurement of resistance, inductance and capacitance using various dc and ac bridges. 4. Identify and select different electronic and electrical transducers for measurement of various electrical and non electrical quantities. 5. Measurement of frequency form of various electrical quantities using CRO and DSO. 6. Apply and utilize different instruments for measurement of basic parameters.
Pr-requisites	Basic Electrical Engineering
Course Type	***Program Core Course***
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1:***Methods of Measurement:*** Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis	***CO1, CO2***	***PO1, PO2***	***PSO1***	***1.2,2.1***	***1.2.1, 2.1.3***	***Classroom teaching***	
Unit 2:Measurements: Principle of moving coil, moving iron and dynamo meter type of instruments. Measurement of low, high and medium resistances. . Power factor meter, maximum demand indicator, AC/DC Potentiometer. Digital Measurement of Electrical Quantities-Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer Loading effect of instrument. Measurement errors.	***CO2, CO3, CO4***	***PO1, PO2, PO4***	***PSO1, PSO2***	***1.2,1.3, 2.1, 4.1***	***1.2.1, 1.3.1, 2.1.3, 4.1.2***	***Classroom teaching and ICT***	
Unit3: Analog Devices : Analog Watt meters and Power Factor Meters: Power and Power Factor, Electrodynamometer type watt meter, power factor meter, Construction, theory, torque equation, Advantages and disadvantages,	***CO2, CO3, CO4***	***PO1, PO2, PO3, PO4***	***PSO1, PSO2***	***1.2,2.2, 3.1, 4.1***	***1.2.1, 2.2.3, 3.1.1, 4.1.2***	***Classroom teaching and ICT***	

active and reactive power measurement in single phase, Measurement in three phase. Analog Energy Meter**:** Single phase induction type energy meters, construction, theory, Operation, lag adjustments, Max Demand meters/indicators.							
Unit 4:DC and AC Bridges: Measurement of resistance, Wheatstone Bridge, Kelvin's Bridge, Kelvin's Double Bridge, loss of charge method for measurement of high resistance, Measurement of inductance, Capacitance, Maxwell's Bridge, De-Sauty Bridge, Anderson Bridge, Schering Bridge, Wien Bridge, Applications and Limitations.	***CO2, CO3, CO4***	***PO1, PO2, PO4, PO5***	***PSO1, PSO2***	***1.3,2.2, 4.1, 5.2***	***1.3.1, 2.2.3, 4.1.3, 5.2.1***	***Classroom teaching and ICT***	
Unit 5:Oscilloscopes: Block diagram, probes, Deflection amplifier and delay line, Trigger Generator, Coupling, Automatic Time Base and Dual Trace Oscilloscopes, Pulse Measurements, Delayed Time Base, Analog Storage, Sampling and Digital Storage Oscilloscopes. Special instruments: Wave Analyzer, Harmonic Distortion Analyzer, Spectrum Analyzer, FFT Analyzer. Introduction to Data Acquisition Systems (DAS): Block Diagram, Specifications and various components of DAS. General purpose Instrumentation Bus (GP-IB): Protocol, SCPI Commands and Applications to DSO and DMM.	***CO3, CO4, CO5***	***PO1, PO2, PO3, PO4, PO5***	***PSO1, PSO2***	***1.2,2.1, 3.1, 4.1,5.2***	***1.2.1, 2.1.2, 3.1.3, 4.1.2, 5.2.1***	***Classroom teaching and ICT***	
Unit 6 :Sensors and transducers: Sensors& transducers for displacement, pressure, temperature etc.; Hall Effect transducers, piezoelectric transducers. ADC/DAC, Instrumentation amplifier, filters. Telemetry systems, Microprocessor based basic power measurement and data acquisition systems	***CO3, CO4, CO6***	***PO1, PO2, PO10***	***PSO1, PSO2, PSO3***	***1.2,2.2, 10.1***	***1.2.1, 2.2.1, 10.1. 2***	***Classroom teaching and ICT***	

Text Books:

1. H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill
2. A.D. Heltric & W.C. Copper, Modern Electronic instrumentation & Measuring instruments, Wheeler Publication.

Reference Books:

1. D. Patranabis, Sensors & Transducers, PHI.
2. A.K.Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co.

E-sources:

1) NPTEL Courses

Course Code : 20UEE403D	***A.C. Machines***	***Total credits: 04***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory : 03 Hrs/week		***Mid sem: 20Marks***
Tutorial: 01Hr/week		***End-Semester : 60 Marks***

Course Objectives	1.To know and understand working principles of single phase and three phase Transformer. 2. To know and understand working principles Induction motors. 3. To know and understand working principles of synchronous machines.
Course Outcomes	Students will understand 1.different connections of three phase transformer and their use. 2. principle of rotating magnetic field. 3. working principles of the induction motor. 4.working principles of synchronous machines. 5.understand characteristics of machines.
Pre-requisites	*Basic Electrical Engineering, D.C. Machines*
Course Type	***Program Core Course***
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1 Single Phase Transformer							
Transformer construction, Ideal and practical transformer, exact and approximate equivalent circuits, no load and on load operation, phasor diagrams, power and energy efficiency, voltage regulation, parallel operation, effect of load on power factor, Per Unit system, excitation phenomenon in transformers, switching transients, Auto transformers, Variable frequency transformer, voltage and current transformers, welding transformers, Pulse transformer and applications	***CO1***	***PO1, PO2***	***PS0 1***	***1.3 2.2***	***1.3.1 2.2.2***	***Interactive Teaching, Chalk and Talk***	
Unit 2 Three Phase Transformers							
:Constructional features of three phase transformers, Cooling methodology, Standard and special transformer connections, Phase conversion, Parallel operation of three phase transformers, three winding transformers and its equivalent circuit, on load tap changing of transformers, Modern trends in transformers, Standards, Type and routine tests, Maintenance of distribution and power transformer	***CO1***	***PO1, PO2***	***PSO 1***	***1.3 2.2***	***1.3.1 2.2.2***	***Problem Based Learning***	

Unit 3 Three phase Induction Motor:								
Types of induction motor, flux and MMF waves, development of circuit model, across air gap, torque and power output, OC and SC tests, circle diagram, starting methods, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator, induction machine dynamics, high efficiency induction motors. Test codes.	***CO2, CO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3 2.2***	***1.3.1 2.2.2***	***Problem Based Learning***		
Unit 4 Synchronous Machines								
Classification of A.C. Machines, principle of operation and constructional features of synchronous and induction machines, rotating MMF waves in A.C. Machines. Armature windings, ac machine windings, winding factors, the EMF equation, harmonics in generated EMF, causes of harmonics and their suppressions Construction, types, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle characteristics, parallel operation of synchronous generators, synchronizing to infinite bus bars, two axis theory	***CO4***	***PO1, PO2***	***PSO1, PSO2***	***1.3 2.2***	***1.3.1 2.2.2***	***Interactive, animation, Chalk and Talk, PPT***		
Unit 5 Synchronous motor:								
Operation, starting methods, characteristic curves, synchronous condenser, dynamics. Test codes	***CO4, CO5***	***PO1, PO2***	***PSO1, PSO2***	***1.3 2.2***	***1.3.1 2.2.2***	***Problem Based Learning***		
Unit 6 Fractional Kilowatt Motors:								
Introduction, single phase induction motors, double revolving field theory, circuit model of single-phase induction motor, determination of circuit parameters. Single phase synchronous motors, permanent magnet ac motors, ac servomotors	***CO5***	***PO1, PO2***	***PSO1, PSO2***	***1.3 2.2***	***1.3.1 2.2.2***	***Chalk and Talk, Interactive, Brainstorming***		

Text Books :

1. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata Mc Graw Hill Publication, 4th Edition 2010, Reprint 2012.
2. A. E. Fitzgerald, C. Kingsley, S. D. Umans, "Electrical Machinery", Tata Mc Graw Hill, 2002, (6th edition).

Reference Books :

1. M. G. Say," Alternating current machines", fifth edition, E.L.B.S. PublicationA.F. Puchstein, T.C. Lloyd, 2. A.G. Conrad, "Alternating current machines", John Wiley and Sons, New York 1954.
3.P.C. Sen, "Principles of Electric Machines and Power Electronics ", John Wiley and Sons Publication, second edition 1997

E-Resources :

1. NPTEL Lectures

Course Code: 20UEE404D	Digital Electronics and Microprocessor	Total credits: 03
Teaching Scheme		Evaluation Scheme
		Mid Sem: 20Marks
Theory: 03 Hrs/week		Simulation Assignment: 20 Marks
Tutorial:		End-Semester: 60

Course Objectives	1. To understand the Boolean algebra and its use in digital electronics. 2. To apply the knowledge of logic families for developing sequential circuits & for developing combinational circuits. 3. To evaluate function of registers, counters, and its application in microcontroller.
Course Outcomes	Students will be able to 1. Understand the Boolean algebra and its use in digital electronics. 2. Apply the knowledge of logic families for developing sequential circuits. 3. Apply the knowledge of logic families for developing combinational circuits. 4. Evaluate function of registers, counters, and its application in microcontroller. 5. Introduced with microprocessor.
Pre-requisites	**Basic knowledge of analog circuits and Boolean algebra.**
Course Type	Program Core Course
Course Contents	

Unit No	CO Mapping	PO Mapping	PSO Mapping	Competency	PI	Teaching Methodology	Remark
Unit 1 Number Systems and Boolean Algebra							
Introduction to Number Systems-Types-Decimal, Binary, Octal, Hexadecimal; Conversion from one number system to other; Binary arithmetic operations; Representation of Negative Numbers;1's complement and 2's complement, Complement arithmetic, BCD code, Digital Codes -Excess-3 code, Gray code, Binary to Excess -3 code conversion and vice versa, ASCII code, Error Detection Codes. Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Min term and Max terms, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map.	CO1	PO1, 2	PSO1, PSO2	1.2 1.5 2.1	1.2.1 1.6.1 2.5.1 2.5.2	Interactive classroom teaching	
Unit 2 Logic Families							
Transistor as a switch, Definition of parameters-current voltage parameters, Fan in, Fan out, Noise Margin, Propagation Delay, Power Dissipation; Resistor Transistor Logic(RTL), Diode Transistor Logic (DTL), Transistor-Transistor Logic (TTL), Integrated Injection Logic (IIL) and MOS-logic, Comparison of Various Logic Families.	CO1 CO2	PO1, 2	PSO1, PSO2	1.2 1.5 2.1	1.2.1 1.6.1 2.5.1 2.5.2	ICT, classroom teaching	
Unit-3: Logic Gates & Sequential Circuits							

Logic Gates-Basic Gates, Other gates, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters, Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops -RS,T,D,JK; Triggering of Flip Flops; Flip Flop conversions; Master-Salve JK.	***CO1 CO2***	***PO1, 2,3***	***PSO1, PSO2***	***1.2 1.5 2.1 2.8 3.7***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.7.1***	***ICT, classroom teaching***	
Unit-4: Combinational Circuits							
Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Substractor - Half and Full Substractor; Parallel adder and Substractor, BCD adder, BCD Substractor, Multiplexer, Demultiplexer, Encoder, Priority Encoder; Decoder ,BCD to Seven segment Display Decoder/Driver, and Comparators	***CO2 CO3***	***PO1, 2,3,4***	***PSO1, PSO2***	***1.2 1.5 2.1 2.8 3.7 4.4***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.7.1 4.4.1***	***ICT, classroom teaching***	
Unit-5: Shift Registers, counters, and converters							
Introduction to shift registers, Basic Shift Register Operations, types of shift registers, Bidirectional Shift Registers, Shift Register Counters: Introduction to counters, Types of Counters-Asynchronous and synchronous counters, Up/Down Synchronous Counters, Cascaded Counters. A/D and D/Converters: Digital to Analog Converter.	***CO2 CO3***	***PO1, 2,3,4***	***PSO1, PSO2***	***1.2 1.5 2.1 2.8 3.7 4.4***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.7.1 4.4.1***	***ICT, classroom teaching***	
Unit -6: Introduction to Microprocessor							
Introduction to 8085/86 microprocessor, Basic block diagram of 8086, basic features of 8086, significance of clock in 8086, Role of register and counter in 8086, Memory Basics, Types-RAM, ROM, Programmable ROMs, Flash Memory, Memory Expansion, Special Types of Memories, Magnetic and Optical Storage, Applications of 8086.	***CO2 CO3***	***PO1, 2***	***PSO1, PSO2***	***1.2 1.5 2.1***	***1.2.1 1.6.1 2.5.1 2.5.2***	***ICT, classroom teaching***	

Textbooks:

1. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill Publication.
2. Anokh Singh “Fundamentals of Digital Electronics & Microprocessor”, S Chand Publication.
3. Jaydeep Chakravorty “3. Digital Electronics and logic design”, Universal Press.

Reference Books:

1. Leach & Malvino, “Digital Principles & Application”, Tata McGraw Hill Publication.
2. Morries Mano “Digital Logic Design”, Prentice Hall Publication

E-sources:

1. ***https://www.nptel.ac.in › courses***
2. ***https://www.coursera.org › courses***

Course Code: 20UEE405E	Analog and Digital Communication	Total credits: 03
Teaching Scheme		Evaluation Scheme
		Mid Sem: 20Marks
Theory: 03 Hrs/week		Simulation Assignment: 20 Marks
Tutorial:		End-Semester: 60

Course Objectives	1. To acquire the knowledge of analog communication modulation scheme. 2. To understand fibre optic and satellite communication. 3. To apply the knowledge of communication to power system & use of different communication protocol for communication in substation
Course Outcomes	Students will be able to 1. Acquire the knowledge of analog communication modulation scheme. 2. Understand fibre optic and satellite communication. 3. Apply the knowledge of communication to power system. 4. Understand design of communication system used at power plant. 5. Use communication protocol for communication in substation.
Pre-requisites	Basic aspects of communication engineering.
Course Type	Professional Elective course

Course Contents

Unit No	CO Mapping	PO Mapping	PSO Mapping	Competency	PI	*Teaching Methodology	Remark
Unit 1: Introduction to analog communication							
Basic schematic of communication systems, Simplex and duplex systems, Modes of communication, broadcast and point to point communication, Necessity of modulation, Modulation and demodulation concepts (AM, FM,PM), TDM and FDM concepts, concept of noise.	CO1	PO1,2	PSO1, PSO2, PSO3	1.2 1.5 2.1 2.8 3.5	1.2.1 1.6.1 2.5.1 2.5.2 2.8.2	ICT, classroom learning using simulator	
Unit 2: Digital and data communication							
Sampling theorem, coding and decoding, Pulse modulation, FSK, PSK, and Modem. OSI reference model, Internet protocol, Packet switching.	CO1	PO1,2	PSO1, PSO2, PSO3	1.2 1.5 2.1 2.8 3.5	1.2.1 1.6.1 2.5.1 2.5.2 2.8.2	ICT, classroom learning using simulator	
Unit 3: Wireless LANS & Virtual Circuit Networks							

OFC techniques and advantages, types of optical fibres and construction, propagation in OF and modulation techniques.	***CO2***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator***	
Unit 4: Satellite communication							
Overview of Satellite communication, Kepler's three laws of planetary motion, orbit parameters.	***CO2***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator***	
Unit 5: Developments in Data communication							
Historic Developments in Data communication over Power lines, Remote energy metering protocols, Communication systems in Power stations, Modulation schemes for PLC, Communications in Power distribution grid.	***CO3***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator***	
Unit 6: Communication Technologies							
Communication Technologies for smart grid: Fiber Optical Networks, WAN based on Fiber Optical Networks, IP based Real Time data Transmission, Substation communication network, Zigbee.	***CO3***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator***	

Textbooks:

1. James Momoh, "Smart Grid: Fundamentals of Design and Analysis", IEEE Computer Society Press.
2. EkanayakeJ.,Jenkins N., Liyanage K., Wu, J., Yokoyama A., "Smart Grid: Technology and applications" , Wiley Publications.

Reference Books:

1. Davis Kennedy, "Electronic Communication Systems", McGraw-Hill publication.

2. Louis Frenzel, "Principles of Electronic Communication Systems" McGraw-Hill publication.

E-sources:

1. ***https://www.nptel.ac.in › courses***
2. ***https://www.coursera.org › courses***

Course Code: 20UEE406E	***Electrical estimation & costing***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
Theory : 3 Hrs/week		***CA: 20 Marks***
Tutorial: --Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks

Course Objectives	1- To Understand Electrical Wiring with IE rules 2- To gain knowledge on Residential Building Electrification 3- To gain knowledge on Commercial Building Electrification. 4- To gain knowledge on Electrification of factory unit Installation
Course Outcomes	Student would be able to 1-Acquire the knowledge of different types wires and wiring systems, I.E. rules and Electric supply act. 2- Explain the importance of earthling, rating of wires & cables, procedures for residential, commercial electrification. 3- Explain procedures for residential, commercial electrification. 4- Able to estimate the length of wire, cable, conduit, earth wire, and earthing 5- Able to estimate cost of residential, commercial electrification..
Pre-requisites	knowledge of Basic Electrical Engg and Network theory
Course Type	***Professional Elective subject***
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***CO Mapping***	***Competency***	***PI***
UNIT-1Electrical Wiring with IE rules						
Introduction, Define types of wires; Different types of wiring system; Comparison of different types of wiring; Different types and specifications of wiring materials; Accessories and wiring tools; Prepare I.E. rules for wiring, including Electricity supply act 2003& 2005; Elements of Estimating: Definition of ―Estimation‖. Types of estimation and estimation tools; Overhead and service charges; Purchase procedure.	***PO1, PO2,PO 3 PO4,PO 5***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO 1 CO 2 CO 3**	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.3 3.1.4 4.1.1 5.1.1**
UNIT-2 Residential Building Electrification General rules						
guidelines for wiring of Residential Installation and positioning of equipment‘s; Principles of circuit design in lighting and power circuits.; Procedures for designing the circuits and deciding the number of circuits.; Method of drawing single line diagram.; Selection of type of wiring and rating of wires &cables.; Load calculations and selection of size of conductor.; Selection of rating of main switch, distributions board, protective switchgear ELCB and MCB and wiring accessories.; Earthing of Residential Installation.; Sequence to be followed for preparing Estimate; Preparation of detailed estimates and costing of Residential Installation.	***PO1, PO2,PO 3 PO4,PO 5***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO 1 CO 2 CO 4 CO 5**	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.3 3.1.4 4.1.1 5.1.1**
UNIT 3: Electrification of commercial Installation I						

Concept of commercial Installation.; Differentiate between electrification of Residential and commercial Installation.; Fundamental considerations for planning of an electrical Installation system for commercial building.; Design considerations of electrical Installation system for commercial building.; Load calculations & selection of size of service connection and nature of supply.;	***PO1, PO2,PO 3 PO4,PO 5***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO 1 CO 2 CO 3**	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.3 3.1.4 4.1.1 5.1.1**
UNIT 4: Electrification of commercial Installation II						
Deciding the size of cables, bus bar and bus bar chambers.; Mounting arrangements and positioning of switch boards, distribution boards main switch etc.; Earthing of the electrical Installation; Selection of type wire, wiring system & layout.; Sequence to be followed to prepare estimate.; Preparation of detailed estimate and costing of commercial Installation	***PO1, PO2,PO 3 PO4,PO 5***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO 1 CO 2 CO 4 CO 5**	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.3 3.1.4 4.1.1 5.1.1**
Unit- 5 Electrification of factory unit Installation I						
Concept of Industrial load.; Concept of Motor wiring circuit and single line diagram. Important guidelines about power wiring and Motor wiring.; Design consideration of Electrical Installation in small Industry/Factory/workshop.;	***PO1, PO2,PO 3 PO4,PO 5***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO 1 CO 2 CO 3**	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.3 3.1.4 4.1.1 5.1.1**
Unit- 6 Electrification of factory unit Installation II						
Motor current calculations.; Selection and rating of wire, cable size & conduct.; Deciding fuse rating, starter, distribution boards main switch etc.; Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing.; Sequence to be followed to prepare estimate.; Preparations of detailed estimate and costing of small factory unit/ workshop	***PO1, PO2,PO 3 PO4,PO 5***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO 1 CO 2 CO 4 CO 5**	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.3 3.1.4 4.1.1 5.1.1**

Text Books:

1. Electrical Design Estimating and Costing, K.B.Raina & S.K.Battacharya, new age international (p) limited.

2. Electrical Estimating & Costing by Surjit Singh (Dhanpat Rai & sons).

3. Electrical Installation Estimating & Costing, Gupta, J.B., S. K. Kataria & Sons, New Delhi

Reference Books:

1. Dr.S.L.Uppal of Electrical Wiring, Estimating and Costing, New Age International (p) Limited, New Delhi.

2. Electrical Estimating & Costing by N. Alagappan & S. Ekambaram(TTTI, Madras) - (Tata Mcgrawhill Ltd).

***E-Source*:** Online courxe on “Electrical Design Estimating and Costing”

Course Code : 20UEE407H	***Rural Transformation***	*Total credits: 01*
Teaching Scheme		*Evaluation Scheme*
	CA :	
Theory: 02Hrs/week	*Mid sem:*	
Tutorial: Hr/week	*End-Semester : 50 Marks*	

Course Objectives	To denote the actions and initiatives taken to improve the standard of living in non-Urban neighborhoods, countryside and remote villages.
Course Outcomes	At the end of the syllabus, 1.To develop the understanding of thesubject. 2.This subject acquaints students with the Rural Society structures and institutions actual working. 3. The subject traces of some of the areas of Rural economy and health issues.
Pre-requisites	
Course Type	Humanities and Social Sciences .
Course Contents	

Unit No.	*CO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Teaching Methodology*	*Remark*
***Unit 1:*Elements of Rural Development**							
Definition of Rural Areas – Meaning of Development – Concept of Rural Development – Causes of Rural Backwardness – Nature and Scope of Rural Development in India Approaches to Rural Development in India: Gandhian Approach – Decentralized Planning Approach – Sectoral Approach – Area Approach – Target Group Approach – Integrated/ Holistic Approach – Participatory Approach – Rights Approach Rural Housing: Status, Problems and Programmes – Drinking Water Supply: Sources, Problems and Programmes – Rural Sanitation: Problems and Programs,Types of Villages in India – Characteristics of Village Communities – Rural Social Institutions – Family, Marriage and Religion: Role and FunctionsDefinition of Caste – Distinction between Caste and Class – Caste system in India – Functions – Emerging trends Concept of Social Change – Factors of Social Change: Demographic, Economic,	***CO 1,CO2***	***1,2***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture and ICT***	

Technological, Cultural – Process of Social Change in India: Sanskritization, Westernization and Modernization Major Social Problems: Poverty,Unemployment, Illiteracy,,Child Labor,Social Legislation.							
Unit 2: Rural Education							
Education in Rural Areas – Problems in school Education, School Dropouts and Girl Child Education , Sarva Siksha Abhiyan ,National Literacy Mission ,National Education Policy,Rural Development Institutions and Strategies,Conceptand Principles of Cooperation Rural Development Policies and Strategies Non-Governmental Organizations, Concept of D-Centralized Planning and its Governance Role of Information and Communication Technology in Rural Development – Technology Missions for Rural Development: Immunization, Communication ,Wasteland Development . Rural Infrastructure: Bharat Nirman – Prime Minister's Grameen Sadak Yojana – Provision of Urban Amenities in Rural Areas (PURA), Conventional and Nonconventional Sources of Energy Development.	***CO 2***	***1,2***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture and ICT***	
Unit 3: Rural Health							
Rural Health – Health Care Services in Rural Areas , Maternal and Child Health .HIV / AIDS – National Health Policy of India, National Rural Health Mission,Trends in Population Growth ,Overpopulation: Causes and Consequences ,Composition of Rural Health.	***CO 3***	***1,2***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture and ICT***	
Unit 4:**Rural Economy**							
Essentials of Project Implementation Rural Development Planning Concept of Farm Management Project Identification ,Rural Development - Planning and Management,Development of Agriculture: Green Revolution, Land Reforms , Dry Land Agriculture ,Importance of Organic Farming, Crop Insurance scheme , Promotion of Allied Activities: Dairying, Sheep/Goat Rearing, Poultry and Aquaculture.Agriculture and Economic Development, Economic Structure of Rural India.	***CO 2,CO3***	***1,2***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture***	

***Unit 5:*Development of Rural Industries**							
Development of Rural Industries: Khadi and Village Industries Commission, District Industries, Pioneering Efforts in Rural Reconstruction: Sriniketan – Martandam – Sevagram – Baroda – Firka Development Scheme – Nilokheri – Etawa Pilot Project Community Development Programme and National Extension Service – Panchayati Raj Institutions, Transfer of Functions and Powers to PRIs Area Development Programmes: Drought Prone Area Programme – Command Area Development Programme – Desert Development Programme – Hill Area Development Programme – Integrated Tribal Development Agency – Tribal Development Corporation, Target Group Programmes – Swarnajayanti Gram Swarojgar Yojana – National Rural Livelihoods Mission – Micro Finance and Self-help Groups for Women Empowerment: Functioning of Velugu in A.P. Employment Generation Programmes – MGNREGS: Strategy, Implementation mechanism, Progress and Problems – Prime Minister's Rojgar Yojana.	***CO 2,CO3***	***1,2***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture and ICT***	

Text Books :

1. Katar Singh: Rural Development principles; policies and Management Second edition sage publications.
2. Ruddar Datt and K.P.M.Sundharam: Indian Economy- S.Chand & Co.Ltd.2004.
3. D.M.Mithani: Managerial Economics. Himalaya Publication House.
4. G L Ray: Extension Communication and Management; Naya prokash; Kolkata.

Reference Books :

1. Misra and Puri: Structure and Problems of Indian Economy-Himalaya Publishing House.
2. Journals of Kurukshetra; Yojana; Planning Commission Reports and Economic Survey of India.
3. Arora R.C: Integrated Rural Development in India-S.Chand -1980-1st edition.

E-Resources :

1. Goverment sites for Yojana and Planning Commission Reports.

Course Code: 20UEE408L	***Electrical Measurement and Instrumentation Lab***	***Total credits: 01***
Execution Scheme		***Evaluation Scheme***
Practical : 2 Hrs/week		***CA: 60 marks End Sem : 40 marks***
Lab outcomes	***1. At the end of this course students will demonstrate the ability to measure the resistance, inductance and capacitance using various dc and ac bridges. 2. Identify and select different electronic and electrical transducers for measurement of various electrical and non electrical quantities. 3Understand the basics of calibration***	

Course Contents

Name Of Practical	***LO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	****Type/Methodology***
1. Study of Moving iron, PMMC and Dynamometer type instruments (Basic moving Systems).	***LO1***	***PO1 &PO2***	***PSO1 &PSO2***	***1.1,2.1***	***1.1.1,2.1.1***	***Demonstrate the device component***
2. Comparative study of temperature measurement using RTD and thermocouple.	***LO1,LO2***	***PO1,PO 2 &PO3***	***PSO1 &PSO2***	***1.2,2.1,3.1,***	***1.2.1,2.1.2,3.1.1***	***Perform the experiment and note the characteristics***
3.Measurement of Power in three phase circuit using two watt meter method	***LO1,LO2***	***PO1,PO 2 &PO3***	***PSO1 &PSO2***	***1.2,1.3,2.1,3.1***	***1.2.1,1.3.1,2.1.2, 3.1.3***	***Perform the experiment and note the characteristics.***
.4.Study of different types of ohm meter	***LO1,LO2***	***PO1 and PO2***	***PSO1***	***1.2,2.2***	***1.2.1,2.2.2***	***Observe and Understand***
5. Study of megger	***LO1,LO2***	***PO1 and PO2***	***PSO1***	***1.2,2.2***	***1.2.1,2.2.2***	***Observe and Understand***
6.Construction of ammeter and voltmeter	***LO1,LO2,LO 3***	***PO1 and PO2***	***PSO1***	***1.2,1.3,2.1***	***1.2.1,1.3.1,2.1.2, 2.1.3***	***Observe and Understand***
7. To study linear variable differential transformer	***LO1,LO2***	***PO1,PO 2 &PO3***	***PSO1 &PSO2***	***1.2,2.1,3.1***	***1.2.1,2.1.2,3.1.2***	***Perform the experiment and note the characteristics.***
8.To study CRO	***LO1,LO2,LO 3***	***PO1 &PO2***	***PSO1***	***1.1,1.3,2.1***	***1.1.2,1.3.1,2.1.3***	***Perform the experiment and observe.***
9. To study measurement of self inductance	***LO1,LO2***	***PO1,PO 2 &PO3***	***PSO1 &PSO2***	***1.1,2.1,3.1***	***1.1.2,2.1.3,3.1.3***	***Perform the experiment and note the characteristics.***

(Anderson Bridge)						
10.Determination of unknown inductance using Maxwell's inductance bridge method	***LO1,LO2***	***PO1,PO 2 &PO3***	***PSO1 &PSO2***	***1.1,2.1,3.1***	***1.1.2,2.1.3,3.1.3***	***Perform the experiment and note the characteristics***

References:

1. A.K.Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co
2. A.D. Heltric & W.C. Copper, Modern Electronic instrumentation & Measuring instruments, Wheeler Publication.

Course Code : 20UEE409L	***A.C. Machines Lab***	***Total credits: 01***
Execution Scheme		***Evaluation Scheme***
Practical Hrs: 2Hrs/week		***CA : 60Marks***
		End-Semester Exam : 40 Marks

Lab Outcomes	Students will be able to 1.conduct various tests on the A.C. machines. 2. obtain different characteristics of A.C. machines 3. find efficiency and regulation of Machines

Course Contents

Name of the Practical	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Name of Practical	***LO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Type/Methodology***	
1. Determination of regulation of alternator by direct loading test on three phase Alternator.	***LO 1***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
2. Load test on three phase squirrel cage induction motor.	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
3. Determination of Squirrel cage induction motor performance from Circle diagram	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
4. Load test on three phase Slip ring induction motor.	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
5. Speed control of three phase Slip ring induction motor.	***LO1, LO2,***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
6. Determination of equivalent circuit parameters of single-phase induction motor.	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
7. Load test on single phase induction motor.	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
8. To plot V curves of synchronous motor.	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
9. Load test on Synchronous motor at various voltages and frequency.	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	

10. Study of induction motor starters.	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
11.To conduct open circuit and short circuit test on transformer	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
12.To study different types of transformer connections	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	

Reference Books :

1.Laboratory Manual for Electrical Machines, 1/e D.P. Kothari & B.S. Umre

Course Code: 20UEE410L	Digital Electronics Lab	Evaluation Scheme
Practical : 02Hrs/week		CA: 60 Marks End sem Exam : 40 Marks
Lab outcomes	Students will be, 1. Introduced with Digital Electronics. 2. Demonstrate different sequential and combinational circuits after learning. 3. Demonstrate their work by implementing a mini project.	

Course Contents						
Name Of Practical	LO Mapping	PO Mapping	PSO Mapping	Competency	PI	*Type/Methodology
1. Implementation of RTL, TTL, DTL logic.	LO1	PO1,2	PSO1,2	1.6 2.1	1.6.1 2.5.1	ICT, Lab Practical Sessions
2. Verification of Logic Gates.	LO1	PO1,2	PSO1,2	1.6 2.1	1.6.1 2.5.1	ICT, Lab Practical Sessions
3. Flip flop working.	LO1	PO1,2	PSO1,2	1.6 2.1	1.6.1 2.5.1	ICT, Lab Practical Sessions
4. Implementation of Half and Full Adder.	LO2	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
5. Implementation of Half and full Substractor.	LO2	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
6. Application of Multiplexer.	LO2	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
7. Application of Demultiplexer.	LO2	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
8. BCD to seven segment decoders.	LO3	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
9. Up down & ring counters.	LO3	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
10. Shift register.	LO3	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
11. Memory devices.	LO3	PO1,2, 3,4	PSO1,2	1.6 2.1 3.6 4.5	1.6.1 2.5.1 3.6.1 4.5.1	ICT, Lab Practical Sessions
12. Implementation of logic circuit.	LO3	PO5	PSO1,2	5.5 5.6	5.5.1 5.6.1	Mini Project.

Course Code:20UEE411L	*Product Design*	*Total credits: 03*
Teaching Scheme		*Evaluation Scheme*
Practctical :2Hrs/week		*CA: 30 Marks*
Tutorial- 1hr/week *Demonstration:1hr/week*		*Mid Sem: 30 Marks*
		End Sem: 40 Marks
Course Objectives	1- To make simple electrical o,mechanical or other products. 2-To Create design documents for knowledge sharing 3. To Manage own work to meet design requirements	
Course Outcomes	Students would be able to 1-Devlope Competence with a set of tools and methods for product design and development. 2- Gain Confidence in their abilities to create a new product. 3-Realize role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production). 4-Acquire ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective. 5- Enhance team working skills.	
Pre-requisites	Basic electrical engineering, Engineering drawing	
Course Type		
Course Contents		

Unit No.	Co Mapping	PO Mapping	PSO Mapping	Competancy	PI	*Teaching Methodology	Remark
UNIT-1 Trigger for Product/ Process/ System, Problem solving approach for Product Design, Disassembling existing Product(s) and understanding relationship of components with each other, Sketching of components, identifying materials and their processing for final product, fitting of components, understanding manufacturing as scale of the components, Reverse engineering	Co1	PO1	PSO1	1.1 2.1	1.1.1 2.1.3	**PPT And Brainstorming**	
UNIT-2 components, understanding manufacturing as scale of the components, Reverse engineering concept, case studies of products in markets, (or in each discipline), underlying principles, Case studies of product failures, revival of failed products, Public/Society's perception of products, and its input into product design.	C02	PO2	PSO1	1.1 2.1	1.1.1 2.1.3	Animations & physical model	

UNIT3: Generation of ideas, Funnelling of ideas, Short-listing of ideas for product(s) as an individual or group of individuals,	C03	PO2 PO4	PSO1	1.1 2.1	1.1.1 2.1.3	Brainstor ming	
Unit-4 Sketching of products, 2D and 3D model making in professional 2D/3D drawing software Market research for need, competitions, scale and cost, Initial specifications of products	Co3	PO2 PO4	PSO1 PSO2	1.1 2.1	1.1.1 2.1.3	*Problem based	
Unit-5 Design and development of an electrical domestic appliance, viz, electric iron, geyser, electric oven, fan etc.	C04	PO2 PO4	PSO1	1.1 2.1	1.1.1 2.1.3	Brainstor ming	
Unit-6 Design and development of a commercial electrical product, viz transformer, motor, Electromagnetic choke, Electronic Choke etc,	C05	PO2 PO4	PSO1 PSO2	1.1 2.1 3.1	1.1.1 2.1.3 3.1.2	*Problem based	

Text Books:

1-Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc. 6. Lidwell, W., Holden, K., & Butler, J. (2010).

Reference books:

1- Product design and development. McGraw - Hill Higher Education. 3. Green, W., & Jordan, P. W. (Eds.). (1999).

2- Human factors in product design: current practice and future trends. CRC Press.

3- Human factors in engineering and design Mc- GRAW- HILL book company, Sanders, M. S., & McCormick, E. J. (1993).

E-Resources:

NPTEL course on “Product Design”

OPEN LAB:

The course includes a Mini Project where students would get an opportunity to make a product from electrical engineering domain or any other interdisciplinary domain. Students would work in open lab model wherein they can work in any laboratory without time restrictions.
Student will build a working model which will be discussed weekly in tutorial session and final assessment would be done at the end of semester.

Course Code : 20UEE412L	***Electrical Workshop Lab***	***Total credits: 01***
Execution Scheme		***Evaluation Scheme***
Practical Hrs: 2Hrs/week		***CA : 30Marks***
		End-Semester Exam : 20 Marks

Lab Outcomes	Students will be able to 1. To develop knowledge of basic electrical symbols 2. To develop skill of designing and developing hardware circuit 3. Develop basic knowledge of wiring. 4. To understand basic operation of domestic appliances

Course Contents

Name of Practical	***LO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Type/Methodology***	***Remark***
1 To study different Electrical Symbols.	***LO 1***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Study and Observation***	
2.To design single phase 50 Hz 230/12 V, 50 VA transformer. .	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
3. To study the characteristics of linear and non-linear load	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
4. To design 12 V DC regulated power supply	***LO1, LO2, LO3***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Design and Performance***	
5.To design staircase wiring.	***LO3,***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Performance***	
6. Study of different domestic appliances such as mixer, refrigerator, washing machines.	***LO4,***	***PO1, PO2***	***PSO1, PSO2***	***1.3, 2.2***	***1.3.1, 2.2.2***	***Study and Performance***	

SEMESTER V

Course Code: 20UEE501D	***Power System Analysis***	***Total credits: 04***
Teaching Scheme		***Evaluation Scheme***
Theory : 3Hrs/week		***CA : 20 Marks***
Tutorial: 1Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks
Course Objectives	1-To understand the symmetrical and unsymmetrical faults in the power system. 2-To acquire the knowledge of voltage control, power system stability and load flow in power system. 3- To analyze the performance of system for symmetrical and unsymmetrical faults	
Course Outcomes	Students will be able to- 1-Analyze and apply the concepts of per unit and symmetrical components. 2-Able to identify and solve symmetrical & unsymmetrical faults. 3-Utilize the knowledge of power system stability to evaluate the operation under steady state & transient state condition. 4-Predict the load demand using load flow analysis. 5-Develop the capability to estimate economical load distribution	
Pre-requisites	Basic Electrical Engineering, Network Analysis	
Course Type	***Program Core Course***	
Course Contents		

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	****Teaching Methodology***	***Remark***
Unit 1: Representation of power system component							
Introduction, Single phase Representation of balanced three phase networks, The one line diagram and impedance or reactance diagram, Per unit system, Advantages of pu system, Per unit representation of a transformer, Per unit impedance diagram of a power system, Complex power, The steady state model of synchronous Machine, Power factor and power control, Salient pole synchronous generator, Loading capability diagram, Power transformer, Transmission of electric power, System protection , Representation of load.	***CO1***	***PO1 PO2***	***PSO1***	***1.3 2.1***	***1.3.1 2.1.2***	***Smart Room Teaching***	
Unit 2: Symmetrical Three-Phase Short Circuit							
Calculation of interrupting capacity of circuit breakers, current limiting reactors, symmetrical components, synthesis of unbalanced phases from symmetrical components, representation of phase variables voltage, current and power in terms of symmetrical components, sequence impedances of power system	***CO1 CO2***	***PO1 PO2***	***PSO1***	***1.3 2.1***	***1.3.1 2.1.3***	***Industrial Visits and Tutorials***	

elements, sequence networks of power system elements, phase shift in star-delta transformer banks.							
Unit 3: Unsymmetrical Short Circuits							
Single line-to-ground, line-to-line, double-line-to-ground faults on unloaded alternators, unsymmetrical faults on power systems, fault through impedance, open conductor faults.	***CO1 CO2***	***PO1 PO2 PO3***	***PSO1, PSO2***	***1.3 2.3***	***1.3.1 2.3.1***	***Action Learning, Case Study***	
Unit 4: Power System Stability							
The stability problem, steady-state stability, transient stability, Swing equation, Equal area criterion of stability, application of equal area criterion, step-by-step solution of the swing equation, factors affecting transient stability	***CO3***	***PO4***	***PSO2***	***4.1***	***4.1.2***	***Peer to Peer, Brainstorming***	
Unit 5: Load Flow Studies							
Formulation of bus admittance matrix, formulation of load-flow equations and their solution techniques, digital computer techniques, reactive power optimization.	***CO4***	***PO4 PO5***	***PSO2***	***4.1 5.1***	***4.1.2 5.1.1 5.1.2***	***Simulation, Smart room Learning, Value Addition Course***	
Unit 6: Automatic Generation & Voltage control							
Introduction, single area and two area load frequency control, and Economic dispatch control, optimal (two area) load frequency control, automatic voltage control, Tie-line bias control	***CO5***	***PO1 PO2***	***PSO1***	***1.3 2.3***	***1.3.1 2.3.1***	***Field Exercise, Group Assignment and Discussion***	

Text Books:

1. Modern power system analysis, Nagrath and Kothari, TMH
2. Power System Analysis", Haddi Saddat, TMH.

Reference Books:

1. "Electrical Power Systems", Ashfaq Hussain, CBS Pbs.
2. "Electrical energy system theory", Elgerd, TMH.
3. "Power system analysis", Bergen, Pearson Pbs
4. "Power System Analysis", Grainger and Stevenson, TMH Pbs.

E-sources: NPTEL course on "Power System Analysis"

Course Code: 20UEE502D		***Total credits: 03***
Teaching Scheme	***Control System Engineering***	***Evaluation Scheme***
Theory : 3 Hrs/week		***CA: 20 Marks***
Tutorial: --Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks

Course Objectives	1-To get knowledge of basic structure of control systems, 2-Understand the concept of feedback system and controllers 3-Modeling physical systems using transfer function to analyse system dynamic and steady state behaviour.
Course Outcomes	Students will able to 1. Categorize different types of system and identify a set of algebraic equations to represent and model a complicated system into a simple form. 2. Characterize any system in Laplace domain to illustrate different specification of the system using transfer function concept. 3. Interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis. 4. Employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions. 5. Formulate different types of analysis in frequency domain to explain the nature of stability of the system.
Pre-requisites	Concept of basic electrical engineering, circuit theory and engineering mathematics.
Course Type	***Program Core Course***
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	**CO Mapping**	**Competency**	**PI**
Unit1: Introduction to control system						
Concept of feedback and Automatic control, Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function.	***PO1, PO2, PO3, PO4***	***PSO1***	***Explanation by Qualitative Teaching & Numerical based***	**CO 1 CO 3**	**1.1 1.4 2.1 3.2 4.1**	**1.1.2 1.4.1 2.1.2 3.2.2 4.1.1**
Unit2: Mathematical modeling of dynamic systems						
Translational & Rotational systems, Mechanical coupling, Liquid level systems, Electrical analogy of Spring– Mass-Dashpot system. Block diagram representation of control systems & its algebra. Signal flow graph. Mason's gain formula.	***PO1, PO2, PO3, PO4***	***PSO1***	***Explanation by Qualitative Teaching & Numerical Based***	**CO 1 CO 3**	**1.1 1.4 2.1 3.2 4.1**	**1.1.2 1.4.1 2.1.2 3.2.2 4.1.1**
Unit 3: Time domain analysis						

Time domain analysis of a standard second order closed loop system. Concept of undamped natural	***PO1,*** ***PO2,*** ***PO3,***	***PSO 1***	***Explanation by Qualitative***	**CO 2** **CO 3** **CO 4**	**1.1** **1.4** **2.1**	**1.1.2** **1.4.1** **2.1.3**

frequency, damping, overshoot, rise time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh-Hurwitz criteria and applications. **Error Analysis:** Steady state errors in control systems due to step, ramp and parabolic inputs. Concepts of system types and error constants.	***PO4***		***Teaching & Numerical based***		**3.2 4.1**	**3.2.2 4.1.2**
Unit 4: Stability Analysis						
Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. **Frequency domain analysis of linear system:** Bode plots, Polar plots, Nichols chart, Concept of resonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot.	***PO1, PO2, PO3, PO4***	***PSO1***	***Explanation by Qualitative Teaching & Numerical based***	**CO 1 CO 3 CO 5**	**1.1 1.4 2.1 3.2 4.1**	**1.1.2 1.4.1 2.1.2 3.2.2 4.1.1**
Unit 5: Control System performance measure						
Improvement of system performance by compensation. Lead, Lag and Lead- lag compensation, PI, PD and PID control.	***PO2, PO3, PO4***	***PSO1***	***Explanation by Qualitative Teaching***	**CO 2 CO 5**	**2.1 3.2 4.1**	**2.1.2 3.2.2 4.1.1**
Unit 6: Control system components						
Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tacho-generators. Actuators. Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control	***PO1, PO2, PO4***	***PSO1***	***Explanation by Qualitative Teaching***	**CO 1 CO 3**	**1.1 1.4 2.1 4.1**	**1.1.2 1.4.1 2.1.2 4.1.1**

Text Books:

1. Automatic Control Systems (With Matlab Programs), *HASAN SAEED,* S. K. Kataria& Sons
2. Control systems, K.R. Varmah, McGraw hill
3. Control System Engineering, D. Roy Chowdhuri, PHI

Reference Books:

1. Digital Control system, B.C. Kuo, Oxford University Press.
2. Control System Engineering, I. J. Nagrath & M. Gopal. New Age International Publication
3. Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education

E-sources: NPTEL course on "Control System Engineering"

Course Code: 20UEE503D	***Microcontroller and Applications***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
		Mid Sem: 20Marks
Theory: 03 Hrs/week		***Simulation Assignment: 20 Marks***
Tutorial:		***End-Semester: 60***

Course Objectives	1. To acquire the knowledge of architecture of microcontroller. 2. To understand interfacing and interrupt features of microcontroller. 3. To develop program for basic applications & interfacing applications & implement microcontroller-based system.
Course Outcomes	Students will be able to 1. Acquire the knowledge of architecture of microcontroller. 2. Understand interfacing and interrupt features of microcontroller. 3. Develop program for basic applications & interfacing applications. 4. Implement microcontroller-based system. 5. Test the developed system.
Pre-requisites	Knowledge of Digital Electronics
Course Type	***Program Core Course***

Course Contents

Unit No	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	****Teaching Methodology***	***Remark***
Unit: 1 Microcontroller Applications							
Implementation of microcontroller-based system working application, Project Report, presentation.	***CO3***	***PO1,2,3,4,5***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.7 4.4 5.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.7.1 4.4.1 5.5.1***	***Project Based Learning***	
Unit:2 Architecture							
Features of microcontroller, block diagram of microcontroller, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial port, interrupt structure, SFRs and their addresses, watch dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory.	***CO1 CO2***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1***	***1.2.1 1.6.1 2.5.1 2.5.2***	***ICT, classroom learning, Group Discussion***	
Unit:3 Assembly Language Programming							

Study of Instruction set- data move, logical, arithmetic, jump and call instructions, timing diagram, simple programs using simulator, use of assembler and C- cross compiler, simulator.	***CO1 CO2***	***PO1,2,3***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.5.1***	***ICT, classroom teaching***	
Unit:4 Microcontroller based system design							
External memory interfacing, decoding reset and clock circuits, expanding I/O, memory mapped I/O, memory addresses decoding, Interrupt handling, timer programming, serial port communication.	***CO2 CO3***	***PO1,2,3***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.5.1***	***ICT, classroom learning using simulator***	
Unit:5 Microcontroller Interfacing							
Interfacing various parallel devices to 8255 PPI, Timer counter 8253, character LCD, ADC0808 & DAC0808 interfacing.	***CO2 CO3***	***PO1,2,3,4 ,5***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5 4.5 5.4***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.5.1 4.5.1 5.4.2***	***ICT, classroom learning using simulator***	
Unit:6 Microcontroller Interfacing II							
Interfacing of DC Motor, Stepper Motor, Sensor interfacing (LDR, temperature, moisture, humidity, current, voltage, IR sensor, proximity sensor), RFID interfacing, wireless protocol interfacing (Wi-Fi, Bluetooth, ZigBee).	***CO2 CO3***	***PO1,2,3,4 ,5***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5 4.5 5.4***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.5.1 4.5.1 5.4.2***	***ICT, classroom learning using simulator***	

Textbooks:

1. Muhammad Ali Mazidi , "The 8051 Microcontroller and Embedded Systems Using Assembly and C" Pearson Publication.
2. Kenneth J Ayala. "The 8051 microcontrollers", Penram International Publishing House.
3. Muhammad Ali Mazidi, "**The AVR Microcontroller and Embedded Systems Using Assembly and C: Using Arduino Uno and Atmel Studio",** Microdigitaled publications.

Reference Books:

1. Myke Predco., "Programming and customizing 8051 microcontroller", Tata Mc.Graw Hill Publication.
2. Thomus Grace, "Programming & Interfacing Atmel AVR Microcontrollers", CENGAGE Learning Custom Publishing.

E-sources:

1. ***https://www.nptel.ac.in › courses***
2. ***https://www.coursera.org › courses***

Course Code: 20UEE504E	Course Title	Total credits: 02
Teaching Scheme	Power Plant Engineering	Evaluation Scheme
Theory : 02 Hrs/week		CA: 20 Marks
Tutorial:00 Hrs/week		Mid Sem: 20 Marks
Practical : 00 Hrs/week		End Sem: 60 Marks

Course Objective	5. Tolearnsources of electrical power and economical aspects in power generation 6. Ability to plot , describe and analyse different plant factors involved with power plant operation and its economics 7. To analyse different types of power plants and its design 8. To learn combined working of power plants and grid interfacing
Course Outcomes	Student will be able to 5. Discuss and Analyse the working and layout of different power plants and its design (steam power plant, nuclear power plant, diesel power plant, gas turbine power plant, solar, wind, hydro power plant). Discuss about its economic and safety impacts 6. Describe and analyse different types of efficiencies related with power plant 7. Plot, describe and analyse different mathematical expressions related to terms and factors involved with power plant operation and its economics 8. Impart the knowledge of Combined working of power plants and grid interfacing
Pre-requisites	Electrical Technology, Electrical Power Generation.
Course Type	Professional Elective course

Course Contents

Unit No.	Co Mapping	PO Mapping	PSO Mapping	Competency	PI	Teaching Methodology	Remark
Unit 1: Plant factors and plant economics *(04Hrs)*							
Connected load, firm power, cold reserve, hot reserve, spinning reserve. Base load and peak load plants, Load curve, load duration curve, integrated duration curve, Cost of generation: Average demand, maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor, Tariff, different types of tariffs, Numerical examples	C01, C03	***PO1***	***PSO1***	1.2	1.2.1	Interactive classroom teaching (ICT) classroom teaching	
Unit 2: Thermal Power Station *(04Hrs)*							
Introduction, selection of sites, main parts of thermal power station and their working, Coal fired boilers (fire tube and water tube, Different units of power thermal plant , calorific value of fuel, Operation and maintenance of steam power plant, heat balance and efficiency , numerical examples	C01, C02, C03	***PO1, PO2, PO3***	***PSO1, PSO3***	1.1 1.2 1.3 2.1 3.1	1.1.2 1.2.1 1.3.1 2.1.3 3.1.1	ICT, classroom teaching	

Unit 3: Nuclear power plant *(04Hrs)*							
atomic number, mass number, isotopes, atomic mass, unit rate of radioactivity, mass equivalent number, binding energy and mass defects , Nuclear fuels, Principles of nuclear energy, main parts of nuclear power station, Lay out of nuclear power plant, nuclear reactor, Basic components of nuclear reactor, types of reactors : pressurized water reactor (PWR), boiling water reactor (BWR), pressurized heavy water reactor(PHWR), gas cooled reactor , nuclear fission process ,nuclear chain reaction , reactor control, Nuclear waste disposal, Site selection of nuclear power plants, numerical examples, India's nuclear power program.	C01, C02, CO3	***P01,PO2,PO3***	***PSO1, PSO3***	1.1 1.2 1.3 2.1 3.1	1.1.2 1.2.1 1.3.1 2.1.3 3.1.1	ICT, classroom teaching	
Unit 4: Diesel Power Plant & Gas Turbine Power Plant *(05Hrs)*							
Diesel Power Plant : General layout, site selection, Components of Diesel power plant, Performance of diesel power plant, maintenance, thermal efficiency of diesel power plant, Advantage , limitations, applications Gas Turbine Power Plant: General layout, site selection ,Components of simple gas turbine power plant, working, gas turbine fuels, maintenance, open-loop and closed-loop gas turbine power plant, operation and control of gas turbine power plant, turbine fuels, improvement of thermal efficiency of gas power plant and applications.	C01, C02, CO3	**PO1, PO2**	**PSO1 ,PSO 3**	1.1 1.2 1.3 2.1	1.1.2 1.2.1 1.3.1 2.1.3	ICT, classroom teaching	

Unit 5: Rentable power plants *(05Hrs)*							
Hydroelectric Power Plant: Energy conversion process of hydro power plant, site selection, hydrology and flow duration curve, mass curve, storage and pondage , layout of hydro-station, constituents of hydro power plant, Classification of hydro power plant: a. according to extent of water flow regulation available, b. according to availability of water head, c. according to type of load, Construction , working and selection of hydro turbines used in different types of hydro power plant: a. High head – Pelton turbine b. Medium head – Francis turbine c. Low head – Kaplan turbine, governing of hydraulic turbines, surge tanks, draft tube, hydro power plants in Maharashtra, simple numerical Solar power plant: The Sun as energy source and its movement in the sky ; Solar Energy received on the Earth ; Primary and Secondary Solar energy and Utilization of	C01, C02, CO3	***PO3 ,CO 7***	***PSO2,PSO 3***	3.1 7.1 7.2	3.1.1 7.1.1 7.2.2	ICT, classroom teaching	

Solar Energy, Series and parallel connections of solar module and array , charge controller, Battery sizing ,output characteristics of solar cells at different temperatures and light intensity, solar thermal electricity generation, solar photovoltaic system Wind power plant: Types of turbines, Coefficient of Power, Betz limit, Wind electric generators, Power curve; wind characteristics and site selection; Potential of wind electricity generation in India and its current growth rate.							
Unit 6: Combined working of power plants and grid interfacing *(04Hrs)*							
Economics of combined working power plants, inter- connections of power stations, base load and peak load stations, Concept of parallel operation of various generating sources and load sharing, need of interconnection between different power plants, concept of Grid, requirement of grid, conditions to interface different power plants to grid.	C04	***PO3***	***PSO1,PSO 3***	3.1	3.1.1		

Text Books:

1. A course in electrical power by J.B.Gupta
2. Electrical Power, Dr. S.L. Uppal
3. Principles of power system by.V.K.Mehta, Rohit Mehta
4. Power system engineering by A.C. Chakrabarti, Soni-Gupta-Bhatnagar

Reference Books:

1. Gupta, B.R., Generation of Electrical Energy, S. Chand& Co. New Delhi,
2. Soni, Gupta, Bhatnagar, A Course in Electrical Power. – Dhanpatrai and Sons 11. System, S.Chand & Co. New Delhi, 2005, ISBN: 9788121924962
3. Nag. P. K. Power Plant Engineering, McGraw Hill, New Delhi, ISBN: 978-9339204044

E-sources:

1. NPTEL course on “Power Plant Engineering”
2. Online course on Solar Energy https://www.udemy.com/topic/solar-energy/
3. Online course on Electrical power system https://www.classcentral.com/course/electric-power-systems

Course Code: 20UEE505E	***Electrical Materials***	***Total credits: 02***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory : 02 Hrs/week		***Mid sem: 20Marks***
Tutorial: -Hr/week		***End-Semester : 60 Marks***

Course Objectives	1.To learn in depth about electric, dielectric, semiconducting and magnetic properties of materials. 2.To provide knowledge of Conductor and Insulators. 3. To know the basic concepts of Optical Properties of Solids and Nano technology
Course Outcomes	1.Students will explain the basic concepts of electrical properties of material. 2.Students will illustrate the concepts of magnetic properties of material. 3.Students will analyse the behavior of different semiconductor materials. 4.Students will utilize the different properties of dielectrics for various applications. 5.Students will acquire knowledge of Nano Material
Pre-requisites	***Basics of Electrical and Electronics Engineering***
Course Type	***Professional Elective course***

Course Contents

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1: Conducting Materials							
Review of energy bands, description of materials, drift velocity, collision time, Mean free path, mobility, conductivity, relaxation time, factors affecting conductivity of materials, types of thermal conductivity, Wiedmann-Franz law, super conductivity, effect of magnetic field, properties and application of high conducting materials, properties and applications high resistive material.	***CO1***	***PO1***	***PSO1***	***1.1***	***1.1.1***	***Using Classroom Teaching***	
Unit 2: Semiconductors							
Review of Si and Ge as semiconducting materials, Continuity Equation, P-N junction, Hall effect, mobility, Drift & Diffusion, Diffusion & Transition capacitances of P-N junction	***CO3***	***PO1***	***PSO1***	***1.1.***	***1.1.1***	***Using PPT Presentation***	
Unit 3: Dielectric Materials							

Behavior of dielectric materials in static electric field, Dipole moments, Polarization, Dielectric constant, Polarizability, Susceptibility, mechanisms of polarization, behavior in alternating field, dielectric loss, loss tangent, types of dielectric & insulating materials, electrostriction, Piezo-electricity, Properties and Applications of gaseous(H2, N2 ,SF6 etc), liquid (transformer oil, capacitor oil, paints etc) and solid (fibrous, paper board, wood, plastic, mica, ceramic material, rubber etc.) Insulators.	***CO4***	***PO2***	***PSO1***	***1.1***	***1.1.1***	***Expert Lecture***	
Unit 4: Magnetic Materials							
Permeability, Magnetic susceptibility, magnetic moment, Magnetization, Dipole moment, types of magnetic materials, Magnetostriction, eddy current & hysteresis losses, applications of silicon steel, soft and hard magnetic material.	***CO2***	***PO2, PO4***	***PSO1***	***2.1 4.2***	***2.1.2 4.2.2***	***Explanation using Graphs and Textbook assignments***	
Unit 5: Optical properties of Solids							
Photo emission, photo emission materials, electro luminescence junction diode, photo emitters, photo transistor, photo resistors, injunction lasers, solar cell, optical properties of semiconductor, application of photo sensitive materials (CRT, Tube light, photo panels).	***CO4***	***PO2, PO4***	***PSO1***	***2.1 4.2***	***2.1.2 4.2.2***	***Classroom discussions***	
Unit 6: Nano Materials							

Introduction, Concept of Energy bands & various Mechanism in Nano-structures, Carbon Nano- structure, Carbon Molecules, Carbon Clusters, Carbon Nano Tubes, Applications of Carbon Nano-tube, Special Topics in Nano Technology such as Single Electron Transistor, Molecular Machines, BN Nano tubes, Nano wires	***CO5***	***PO1, PO4***	***PSO1***	***1.1 4.2***	***1.1.1 4.2.2***	***Using videos and Animations***	

Text Books :

1. Electrical Engineering Materials: A.J. Dekker; PHI.
2. Electronic Devices & Circuits: Millman&Halkias; MGH.
3. Nanotechnology- A gentle introduction to next big idea by Mark Ratner & Daniel Ratner, Pearson Education.
4. Science of Engineering Materials and Carbon Nanotubes by C.M. Srivastava and C. Srinivasan, New Academic Science Ltd.
5. Electrical Engineering Materials, T.T.T.I. Madras, McGraw Hill Education
6. Electrical Engineering Materials by K.B.Raina & S.K.Bhattacharya, S.K.Kataria & Sons, Delhi-06.

Reference Books :

1. Electrical Engineering Materials: S.P Seth & P.V Gupta; Dhanpat Rai.
2. Solid State Electronic Devices: StreetMan& Banerjee; Pearson.
3. Electronic Devices & Circuit Theory: Boylestad&Nashelsky; Pearson.
4. Semiconductor devices: Jaspreet Singh; John Wiley.

Course Code : 20UEE506E	***ANALOG & INTEGRATED CIRCUITS***	***Total credits: 02***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory : 02Hrs/week		***Mid sem: 20Marks***
Tutorial: -Hr/week		***End-Semester : 60 Marks***

Course Objectives	**1.** To equip the students with a sound understanding of fundamentals of operational amplifiers **2.** To understand the wide range linear & non-linear applications of operational amplifiers **3.** To introduce special function integrated circuits**.**
Course Outcomes	At the end of course, students will be able to: 1.state & demonstrate specifications of operational amplifier. 2. compare use of op-amp in instrumentation amplifier. 3. design different application circuits using IC 741. 4. design different application circuits using IC 555. 5. design of op-amp based data converters.
Pre-requisites	Electronic Devices & Circuits.
Course Type	***Engineering Professional course***

Course Contents

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
UNIT 1: Review of operational amplifier							
Block diagram of op-amp, Pin diagram of IC 741, Inverting & Non-inverting configutaions of op-amp, Virtual ground effect, Ideal & practical op-amp parameters, Effect of finite open loop gain, bandwidth and slew rate on circuit performance.	***CO1***	***PO1,2,12***	***PSO 1***	***1.6***	***1.6.1***	***ICT TOOLS***	
UNIT 2: Op-amp with negative feedback							
Introduction, Feedback configurations, Voltage series feedback, Voltage shunt feedback, Properties of practical op-amp. Op-amp applications: Inverting and non inverting amplifier, DC and AC amplifiers, Summing, Scaling and averaging amplifiers,	***CO2***	***PO1,2,12***	***PSO 1***	***1.6*** ***2.1***	***1.6.1*** ***2.5.1***	***ICT TOOLS***	

Instrumentation amplifier.							
UNIT 3: Op-amp applications							
Voltage to current converter, Current to voltage converter, Integrator, Differentiator, Precision rectifiers, Log and antilog amplifier, Phase shift and Wien bridge oscillators, Astable and monostable multivibrators, Triangular and saw tooth wave generators, Comparators, Zero crossing detector, Schmitt trigger, First and second order low pass, High pass, Band pass and band reject filters, Design of filters using Butterworth approximation.	***CO1, 3***	***PO1,2,12***	***PSO 1***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	
UNIT 4 : Specialized ICs and its applications							
Timer IC 555 : Astable and monostable operations, applications. Analog Multiplier, Voltage Controlled Oscillator IC AD633 and their applications, Phase Locked Loop Operation, Closed loop analysis, Lock and capture range, Basic building blocks, PLL IC 565.	***CO1, 4***	***PO1,2,3, 12***	***PSO 1 &2***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	
UNIT 5: Voltage Regulaters							
Fixed voltage regulators, 78XX and 79XX series, Adjustable voltage regulators, Low voltage and high voltage configurations of IC 723, Current boosting, Current limiting, Short circuit and Fold-back protection.	***CO1***	***PO1,2,12***	***PSO 1 &2***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	

UNIT 6: Data Converters							
D/A converter - Specifications, Weighted resistor type, R-2R Ladder type, A/D Converters - Specifications, Classification, Flash type, Counter ramp type, Successive approximation type, Single slope type, Dual slope type, Sample-and-hold circuits.	***CO1***	***PO1,2,3,12***	***PSO 1***	***1.6*** ***3.8***	***1.6.1*** ***3.8.3***	***ICT TOOLS***	

Text Books:

1. Franco S., Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata McGraw Hill, 2008
2. Salivahanan S. ,V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008

Reference Books:

1. Botkar K. R., Integrated Circuits, 10/e, Khanna Publishers, 2010
2. C.G. Clayton, Operational Amplifiers, Butterworth & Company Publ. Ltd. Elsevier, 1971
3. David A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010.
4. Gayakwad R. A., Op-Amps and Linear Integrated Circuits, Prentice Hall, 4/e, 2010.
5. R.F. Coughlin & Fredrick Driscoll, Operational Amplifiers & Linear Integrated Circuits, 6th Edition, PHI,2001.
6. Roy D. C. and S. B. Jain, Linear Integrated Circuits, New Age International, 3/e, 2010.

E-sources:

1. Semiconductor Devices online course on www.coursera.org
2. Analog Electronic Circuits NPTEL online course by IITKGP

Course Code : 20UEE508H	Engineering Economics	Total credits: 02
Teaching Scheme		Evaluation Scheme
		CA : - Marks
Theory : 02 Hrs/week		Mid sem: -Marks
Tutorial: -Hr/week		End-Semester : 60 Marks

Course Objectives	1. To learn the basics of economics and cost analysis relevant to engineering so as to take economically sound decisions 2.To Distinguish between simple and complex problems. 3. To Discuss and Describe the role and purpose of engineering economic
Course Outcomes	1. Students will interpret the various basic economic principles 2. Students will relate the economic fundamentals with engineering practices 3. Students will infer the macro-economic aspects of engineering projects 4. Students will able to solve simple problems associated with engineering judgment making 5.Students will able to understand market structures, pricing and international trade
Pre-requisites	-
Course Type	**Professional Elective course**

Course Contents

Unit No.	CO Mapping	PO Mapping	PSO Mapping	Competency	PI	Teaching Methodology	Remark
Unit I Basic Economic Concepts							
Needs, wants, means/resources – marginal principle and economic efficiency, trade - off, opportunity cost, rationality, externalities, differences between micro economics and macroeconomics.	CO 1	PO1	PSO1	1.1	1.1.1	Using Classroom Teaching	
Unit II Demand and Supply							
Meaning and determinants of demand and supply, law of demand and law of supply equilibrium between demand and supply. The concept of elasticity – meaning and types.	CO2	PO6	PSO1	6.2	6.2.2	Using PPT Presentation	
Unit III Production, Cost and Revenue							
Production function, law of variable proportion and laws of returns to scale, different types of costs – variable cost, fixed cost, total cost, average cost, average fixed cost, average variable cost and marginal cost, Total revenue, average revenue and marginal revenue, profit function	CO3	PO1, PO11	PSO1	1.1 11.1	1.1.1 11.1.1	Using Case study	
Unit IV Market Structures, Pricing and International Trade							

Market Structures & Pricing - Concept of market and equilibrium characteristics of perfect competition, monopoly, monopolistic competition and oligopoly– price determinations	***CO4***	***PO2, PO4***	***PSO1***	***2.2 4.2***	***2.2.2 4.2.2***	***Explanation using Graphs and Group discussion***	

International Trade - Meaning and significance of International Trade, Cases for and against globalization. World Trade Organization (WTO) – functions and recent deliberations in World Trade Organization (WTO)							
Unit V Macro-Economic Environment							
Basic macro- economic concepts – aggregate demand aggregate supply, money, income employment consumption savings and investment. National Income Accounting-concepts and methods of national income – recent changes in the methodology of national income accounting.	***CO4***	***PO3, PO4***	***PSO1***	***3.1 4.1***	***3.1.1 4.1.1***	***Using assignments***	
Unit VI Banking and Inflation							
Banking: Meaning and functions of commercial banks and central bank Inflation: Meaning, and types of inflation, Causes and effect of inflation on different sectors of the economy	***CO5***	***PO2, PO12***	***PSO1***	***2.2 12.1***	***2.2.2 12.1.1***	***Using Expert Lecture***	

Text Books :

4. Principles of Economics: P.N. Chopra (Kalyani Publishers).
5. Modern Economic Theory – K.K. Dewett (S.Chand)
6. Micro Economic Theory – M.L. Jhingan (S.Chand)
7. Modern Micro Economics : S.K. Mishra (Pragati Publications)
8. Economic Theory – A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.)
9. Indian Economy: Rudar Dutt & K.P.M. Sundhram.
10.

Reference Books :

1. Mankiw, N. G. Principles of Economics. Mason. Mason,USA: South-Western Cengage Learning.
2. Samuelson P. A. & Nordhaus, W.D. Economics. India: Tata McGraw Hill Education.
3. Pindyck, R.S., Rubinfeld, D. L. & Mehta, P. L. Micro Economics. New Delhi, India: Pearson.
4. Ahuja H.L. Modern Economics. New Delhi,India: S. Chand & Company Ltd.
5. Dornbusch, R., Fisher, S, & Startz, R. Macro Economics. India: Tata McGraw Hill Education.
6. Gupta, G. S. Macro Economics Theory and Applications. India:Tata McGraw Hill.
7. A Text Book of Economic Theory Stonier and Hague (Longman's Landon)

E-Resources :

1. **NPTEL and Swayam**

Course Code : 20UEE509C	*Foreign Language-German*	*Total credits: 01*
Teaching Scheme		*Evaluation Scheme*
		CA : -
Theory : 01Hrs/week		*Mid sem: -*
Tutorial: -Hr/week		*End-Semester : 50 Marks*

Course Objectives	1-To discuss significance of learning language for engineer. 4. To learn German language grammer. 5. To acquire capability of reading writning and speaking GERMAN.
Course Outcomes	1-Student would be able to realize significance of GERMAN language. 2-Student would be able to build German language vocaboulary. 3-Student would be able build grammatically correct German sentences. 4-Student would be able to express himslef in German Language. 5-Student would be able to refer German engineering literature.
Pre-requisites	-
Course Type	Humanities & Social Sciences

Course Contents

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1 : Basic Concepts							
Introduction to German alphabets, phonetics and pronunciation	**CO1**	**PO6** **PO8**	**PS03**	***10.1***	***10.1.1*** ***10.1.2***	**Discussion**	
Unit 2 : verbs							
Introduction to different types of articles and verbs, Nouns – number & gender, pronouns, present and simple past tense	**CO2**	**PO6** **PO9**	**PS03**	***10.2***	***10.2.1*** ***10.2.1***	**Discussion**	
Unit 3 : adjective and adverbs							
Detailed overview of articles, adjectives with/without articles, Prepositions – dative & accusative, Introduction to perfect tense and future, pronominal verbs	**CO3**	**PO6** **PO8**	**PS03**	***10.3***	***10.3.1*** ***10.3.2***	**Discussion**	

Unit 4: active and passive speech							
. **Grammar:** Active/passive voice, genitive forms and reported speech	**CO4**	**PO6 PO12**	**PS03**	***10.3***	***10.3.1 10.3.2***	**Discussion**	
Unit 5: Expressing self in German							
Expressing orally and in writing about opinion, beliefs and suggestions about simple matters related to personal likes/dislikes	**CO5**	**PO6**	**PS03**	***12.1 12.2***	***12.1.1 12.2.1***	**Discussion**	

Text Books :

1-Complete German Beginner to Intermediate Book and Audio Course by Heiner Schenke

2- The Everything Learning German Book by Edward Swick

Reference Books :

1-German Grammar You Really Need To Know: Teach Yourself by Jenny Russ

E-Resources :

1- Language lab.

Course Code: 20UEE510L	Course Title	Total credits: 01
Execution Scheme	Control System Engg Lab	Evaluation Scheme
Practical : 2 Hrs/week		CA: 60marks End Sem:40 marks

Lab outcomes	1-Student would be able to Simulate, analyse control system Behaviour using software simulator/hardware 2- Student would be able to Simulate, analyse the performance of system using root locus, bode, Nyquist plot etc 3- Student would be able to Analyze the different types of controllers like PI, PD, PID
Course Contents	

Name Of Practical	Type/Methodology	PO Mapping	LO Mapping	PSO Mapping	COMPETENCY	PI
Experiment 1: Familiarization with MATLAB & control system tool box	Plotting graphs & library functions	PO1 PO2 PO5	LO 1	PSO1	1.1 2.4 5.1	1.1.1 2.4.2 5.1.1
Experiment 2: To study input output characteristic of various control system components	Through hardware or software simulation	PO2 PO5	LO 1	PSO1	2.4 5.1	2.4.2 5.1.1
Experiment 3: To obtain step response and find time response specification of electrical system, hydraulic system, pneumatic system etc	Programming using MATLAB library functions	PO2 PO5	LO 1	PSO1	2.4 5.1	2.4.2 5.1.1
Experiment 4: Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using matlab	Programming using MATLAB library functions	PO1 PO2 PO5	LO 1	PSO1	1.1 2.4 5.1	1.1.1 2.4.2 5.1.1
Experiment 5: Use Matlab to study effect of feedback gain on system response.	Programming using MATLAB library functions	PO1 PO2 PO5	LO 2	PSO1	1.1 2.4 5.1	1.1.1 2.4.2 5.1.1
Experiment 6: Determination of Nyquist plot using MATLAB	Programming using MATLAB library functions	PO1 PO2 PO5	LO 2	PSO1	1.1 2.4 5.1	1.1.1 2.4.2 5.1.1
Experiment 7 : Use Matlab to obtain root locus for a given system and find performance specifications.	Programming using MATLAB library functions	PO1 PO2 PO5	LO 2	PSO1	1.1 2.4 5.1	1.1.1 2.4.2 5.1.1
Experiment 8: Use Matlab to get bode plot and obtain gain margin and phase margin for various systems.	Programming using MATLAB library functions	PO1 PO2 PO5	LO 2	PSO1	1.1 2.4 5.1	1.1.1 2.4.2 5.1.1
Experiment 9: Determination of PI, PD and PID controller action of first order simulated process.	Programming using MATLAB library functions	PO2 PO5	LO 3	PSO1	2.4 5.1	2.4.2 5.1.1

Experiment 10 : Evaluation of steady state error, setting time , percentage peak overshoot, gain margin, phase margin with addition of compensator	***Programming using MATLAB library functions***	***PO2 PO5***	***LO 3***	***PSO1***	***2.4 5.1***	***2.4.2 5.1.1***

Course Code: 20UEE511L	*Microcontroller Application Lab*			*Evaluation Scheme*		
Practical : 02Hrs/week				*CA: 60 Marks* *End sem Exam : 40 Marks*		
Lab outcomes	*Students will be,* *1. Introduced with microcontroller.* *2. Have knowledge of programming and designing.* *3. Demonstrate their work by implementing a system.*					
Course Contents						
Name Of Practical	*LO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	**Type/ Methodology*
1. Introduction to the study kit and simulator.	*LO1*	*PO1,2*	*PSO1,2*	*1.6* *2.1*	*1.6.1* *2.5.1*	*ICT, Lab Practical Sessions*
2. Arithmetic Operation using microcontroller. (Addition, Subtraction, Multiplication, Division)	*LO1* *LO2*	*PO1,2,3*	*PSO1,2*	*1.6* *2.1* *3.6*	*1.6.1* *2.5.1* *3.6.1*	*ICT, Lab Practical Sessions*
3. Logical Operation using microcontroller. (logic gates and Boolean equations)	*LO1* *LO2*	*PO1,2,3*	*PSO1,2*	*1.6* *2.1* *3.6*	*1.6.1* *2.5.1* *3.6.1*	*ICT, Lab Practical Sessions*
4. Finding the largest/Smallest number out of array.	*LO1* *LO2*	*PO1,2,3*	*PSO1,2*	*1.6* *2.1* *3.6*	*1.6.1* *2.5.1* *3.6.1*	*ICT, Lab Practical Sessions*
5. Number sorting in ascending and descending order.	*LO1* *LO2*	*PO1,2,3*	*PSO1,2*	*1.6* *2.1* *3.6*	*1.6.1* *2.5.1* *3.6.1*	*ICT, Lab Practical Sessions*
6. Delay generation using registers and timers.	*LO1* *LO2*	*PO1,2,3,5*	*PSO1,2,3*	*1.6* *2.1* *3.6* *5.4* *5.5*	*1.6.1* *2.5.1* *3.6.1* *5.4.1* *5.5.2*	*ICT, Lab Practical Sessions*
7. Interfacing of LED to the microcontroller.	*LO2* *LO3*	*PO1,2,3,5*	*PSO1,2,3*	*1.6* *2.1* *3.6* *5.4* *5.5*	*1.6.1* *2.5.1* *3.6.1* *5.4.1* *5.5.2*	*ICT, Lab Practical Sessions*
8. Interfacing of Seven Segment Display to the microcontroller.	*LO2* *LO3*	*PO1,2,3,5*	*PSO1,2,3*	*1.6* *2.1* *3.6* *5.4* *5.5*	*1.6.1* *2.5.1* *3.6.1* *5.4.1* *5.5.2*	*ICT, Lab Practical Sessions*
9. Interfacing of Keyboard to the microcontroller.	*LO2* *LO3*	*PO1,2,3,5*	*PSO1,2,3*	*1.6* *2.1* *3.6* *5.4* *5.5*	*1.6.1* *2.5.1* *3.6.1* *5.4.1* *5.5.2*	*ICT, Lab Practical Sessions*
10. Interfacing of LCD display to the microcontroller.	*LO2* *LO3*	*PO1,2,3,5*	*PSO1,2,3*	*1.6* *2.1* *3.6*	*1.6.1* *2.5.1* *3.6.1*	*ICT, Lab Practical Sessions*

				5.4 *5.5*	*5.4.1* *5.5.2*	
11. Interfacing of DC motor and stepper motor to the microcontroller.	***LO2*** ***LO3***	***PO1,2,3,5***	***PSO1,2,3***	*1.6* *2.1* *3.6* *5.4* *5.5*	*1.6.1* *2.5.1* *3.6.1* *5.4.1* *5.5.2*	***ICT, Lab Practical Sessions***
12. Interfacing of sensors to the microcontroller	***LO2*** ***LO3***	***PO1,2,3,5***	***PSO1,2,3***	*1.6* *2.1* *3.6* *5.4* *5.5*	*1.6.1* *2.5.1* *3.6.1* *5.4.1* *5.5.2*	***ICT, Lab Practical Sessions***
13. Implementation of project and report	***LO3***	***PO1,2,3,5,11***	***PSO1,2,3***	*1.6* *2.1* *3.6* *5.4* *5.5* *11.5*	*1.6.1* *2.5.1* *3.6.1* *5.4.1* *5.5.2* *11.5.1*	***Problem based learning.***

Course Code: 20UEE512L	*Computer Programming and Simulation Lab*	*Total credits: 01*
Execution Scheme		*Evaluation Scheme*
Practical Hrs: 2Hrs/week		*CA: 60Marks*
		End-Semester Exam: 40 Marks

Lab Outcomes	Students will be able to 1. To understand the basics of MATLAB / SCILAB/Pspice 2. To understand the visualization and file I/O functions 3. To design the graphical user interface for programs 4. To simulate the electrical circuits.
Course Contents	

Name of Practical	*LO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Type/Methodology*
1. Write programs to study basic matrix operations, decision making constructs and looping constructs, functions of MATLAB and SCILAB.	*LO 1*	*PO1, PO2*	*PSO1, PSO2*	*1.3, 2.2*	*1.3.1, 2.2.2*	*Simulation/ programming*
2. To plot signal waveforms in purely inductive, purely resistive and capacitive circuits.	*LO1, LO2, LO3*	*PO1, PO2*	*PSO1, PSO2*	*1.3, 2.2*	*1.3.1, 2.2.2*	*Simulation/ programming*
3. Write a program to plot frequency response of LP/HP filters.	*LO1, LO2, LO3*	*PO1, PO2*	*PSO1, PSO2*	*1.3, 2.2*	*1.3.1, 2.2.2*	*Simulation/ programming*
4.Write a program to plot the transient response of the given RC and RL circuits using analytical solution and also using ODE solver	*LO1, LO2, LO3*	*PO1, PO2*	*PSO1, PSO2*	*1.3, 2.2*	*1.3.1, 2.2.2*	*Simulation/ programming*
5. Write a program to plot the transient response of the given RC and RL circuits using function in symbolic math tool box.	*LO1, LO2,*	*PO1, PO2*	*PSO1, PSO2*	*1.3, 2.2*	*1.3.1, 2.2.2*	*Simulation/ programming*
6. Simulation of different electrical networks	*LO1, LO2, LO3*	*PO1, PO2*	*PSO1, PSO2*	*1.3, 2.2*	*1.3.1, 2.2.2*	*Simulation/ programming*

References:

1. Rudra Pratap, “Getting Started with MATLAB 7”, Oxford University Press (Indian Edition) 2006.

2. O. Beucher and M. Weeks, “Introduction to MATLAB and Simulink: A Project Approach”, Second Edition, 2007, Jones & Bartlett Publishers

SEMESTER VI

Course Code :20UEE601D	*Power Electronics*	*Total credits: 04*
Teaching Scheme		*Evaluation Scheme*
		Project : 25 Marks
Theory : 03 Hrs/week		*Case Study : 25 Marks*
Project : 02Hr/week		*Project : 50*

Course Objectives	1. To understand the applications of Power Electronics in modern Electrical systems 2. To learn construction, operation and application of various semiconductor switches 3. To understand various power conversion methodologies i.e. inverter, rectifier, chopper & SMPS.
Course Outcomes	Students will be able to 1. To understand basics of power semiconductor. 2. To analyze the characteristics of semiconductor devices. 3. To analyse & reproduce electrical power conversion methods. 4. To design various Power Converters. 5. To demonstrate control strategies like PWM,SPWM SVPWM etc.
Pre-requisites	EDC
Course Type	*1 – Program Core Course*
Course Contents	

Unit No.	*CO Mapping*	*PO Mapping*	*PSO Mapping*	*Com pe-tency*	*PI*	*Teaching Methodology*	*Remark*
Unit 1 Applications of Power Electronics							
Application of Power Electronics devices in Real world. i.Motor control with emphasis on Traction and Industrial Process control. ii.Power Supplies - Revolution in Personal Computers UPS iii.Power Transmission - Facts Technology, HVDC iv.Chemical Process v.Battery chargingvi.Power extraction from non-conventional enery sources vii.Automotive electronics. .	***CO1 CO2***	***PO1 PO2***	***PSO1***	***1.2 1.5 2.5***	***1.2.1 1.5.1 2.5.1 2.5.3***	***Interactive teaching with the help of ICT***	
Unit 2 : Power Electronics devices							
Advantages over conventional systems. Classification of Semiconductors. Construction, Operation & O/P characteristics of BJT,MOSFET,IGBT,SCR,TRIAC,DIAC,MCT, GTO. Construction of SCR, Operating modes, Two transistor analogy, Static &dynamic	***CO1 CO2***	***PO1 PO2***	***PSO1***	***1.2 1.5 2.5***	***1.2.1 1.5.1 2.5.1 2.5.3***	***Interactive teaching with the help of ICT***	

characteristics, Gate characteristics, Turn on & turn off methods (Commutation methods).							
Unit 3 : AC-DC converters(RECTIFIERS)							
Uncontrolled :Single phase and three phase rectifiers, Performance parameters, comparison of diode rectifiers. Controlled :Single phase and three phase half (semi) and full converters: Quadrants of operation, circuit configurations, working, performance parameters and input-output waveforms for R, R-L and RLE loads. Dual converter in circulating and non-circulating current modes, PWM Converters	***CO3*** ***CO4*** ***CO5***	***PO1*** ***PO2*** ***PO3*** ***PO4*** ***PO5***	***PSO1*** ***PSO2*** ***PSO3***	***1.2*** ***1.5*** ***2.5*** ***3.5*** ***4.5*** ***5.5***	***1.2.1*** ***1.5.1*** ***2.5.1*** ***2.5.3*** ***3.5.1*** ***4.5.2*** ***5.5.2***	***Project*** ***Based*** ***Teaching***	
Unit 4: DC-AC Converters(INVERTERS)							
Single phase and three-phase thyristor bridge circuits, output waveforms for R and R-L loads.PWM techniques-Single, Multiple and Sinusoidal PWM. PWM Inverters: Principle of operation, Performance parameters, Working of single phase and three phase circuits, Current Source invt.	***CO3*** ***CO4*** ***CO5***	***PO1*** ***PO2*** ***PO3*** ***PO5***	***PSO1*** ***PSO2*** ***PSO3***	***1.2*** ***1.5*** ***2.5*** ***3.5*** ***5.5***	***1.2.1*** ***1.5.1*** ***2.5.1*** ***2.5.3*** ***3.5.1*** ***5.5.2***	***Project*** ***Based*** ***Teaching***	
Unit 5: DC-DC Converters (CHOPPERS)							
Step-up and step-down configurations, CLC and TRC techniques, PWM and FM techniques. Practical transistorized chopper circuits: working, control, output waveforms, continuous and discontinuous current conduction.	***CO3*** ***CO4*** ***CO5***	***PO1*** ***PO3*** ***PO4***	***PSO1*** ***PSO2*** ***PSO3***	***1.2*** ***1.5*** ***3.5*** ***4.5***	***1.2.1*** ***1.5.1*** ***3.5.1*** ***4.5.2***	***Project*** ***Based*** ***Teaching***	
Unit 6: Switch Mode Power Supplies							
Buck Converter, Boost Converter, Buck Boost Converter, Flyback Converter, Resonant Converter, battery charger circuits & UPS.	***CO3*** ***CO4*** ***CO5***	***PO1*** ***PO3*** ***PO4***	***PSO1*** ***PSO2*** ***PSO3***	***1.2*** ***1.5*** ***3.5*** ***4.5***	***1.2.1*** ***1.5.1*** ***3.5.1*** ***4.5.2***	***Project*** ***Based*** ***Teaching***	

Text Books :

1. M.H.Rashid, “Power Electronics”, P H I Pub., 3rd Edition,2004.
2. Mohan, Undeland, Robbins, “Introduction to Power Electronics”, John Willey & Sons.
3. B.W.Williams, “PowerElectronics”, JohnWilley,.

Reference Books :

1. S.B.Dewanand Straughan, “Power Semiconductor Circuits”, John Willey
2. B.K.Bose, “Power Electronics and AC Drives”, Pearson
3. M.H.Rashid, “SPICE for Power Electronics”, McGraw-Hill International..

E-Resources :

2. ***https://nptel.ac.in › courses***
3. ***https://ocw.mit.edu › courses***

Course Code : 20UEE601D	***Electromagnetic Engineering***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
		CA : 20 Marks
Theory : 03Hrs/week		***Mid sem: 20Marks***
Tutorial: -Hr/week		***End-Semester : 60 Marks***
Course Objectives	1. To understand vector relations in different forms. 2. To analyze different laws and their solution. 3 To study about magneto statics. 4.To understand time varying field and effect of magnetism in transmission	
Course Outcomes	Students will able to 1. To understand vector relations in different forms 2. To understand different laws and will be able to obtain solutions. 3. To understand magneto statics. 4. To understand time varying fields 5. To understand effect of magnetism in transmission.	
Pre-requisites	Basic electrical engineering, physics	
Course Type	***Program Elective Course***	
Course Contents		

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1 Introduction							
Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's Stoke's and Helmholz theorems .	***CO1***	***PO1, PO2***	***PSO1***	***1.3, 2.2***	***1.3.1 2.2.2***	***PPT, Interactive***	
Unit 2 : Electrostatics:							
Electric field vectors-electric field intensity, flux density & polarization. Electric field due to various charge configurations. The potential functions and displacement vector Gauss's law, Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mappings and concept of field cells.	***CO2***	***PO1, PO2***	***PSO1***	***1.3, 2.2***	***1.3.1 2.2.2***	***Brainstorming, Chalk and Talk***	
Unit 3 : Magnetostatics:							
Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law.	***CO3***	***PO1, PO2***	***PSO1***	***1.3, 2.2***	***1.3.1 2.2.2***	***PPT, Interactive***	
Unit 4: Electromagnetism:							
Magnetic scalar and vector potential. Energy stored in magnetic field, Boundary conditions, Analogy between electric and	***CO3***	***PO1, PO2***	***PSO1***	***1.3, 2.2***	***1.3.1 2.2.2***	***PPT, Interactive***	

magnetic field, Field mapping and concept of field self & mutual inductance							
Unit 5: Time Varying Fields							
Faraday's law, Displacement currents and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflections, refraction & polarization of UPW, standing wave ratio. Pointing vector and power considerations	***CO4***	***PO1, PO2***	***PSO1***	***1.3, 2.2***	***1.3.1 2.2.2***	***Chalk and Talk***	
Unit 6 Transmission Lines:							
The high-frequency circuit. LCR ladder model. The transmission Lin equation. Solution for loss-less lines. Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions. VSWR	***CO5***	***PO1, PO2***	***PSO1***	***1.3, 2.2***	***1.3.1 2.2.2***	***Chalk and Talk***	

Text Books :

1. R. S. Kshetrimayum, Electromagnetic Field Theory, Cengage Learning. 2012
2. J. D. Kraus: Electromagnetic. 5th edition, MGH. 1999
3. Hayt W.H., "Engineering Electromagnetics", 2013, Eighth Edition, Tata Mc-GrawHill

Reference Books :

1. S. 1. G. S. N. Raju: Electromagnetic Field Theory and Transmission Lines, Pearson. 2006
2.Baskaran and K. Malathi: Electromagnetic Field and Waves, Scitech Pub. 2013

E-Resources :

1.NPTEL Lectures

Course Code: 20UEE603D	***Electrical Machine Design***	***Total credits: 04***
Teaching Scheme		***Evaluation Scheme***
Theory : 3Hrs/week		***CA : 20 Marks***
Tutorial: 1Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks

Course Objectives	1-To analyze different materials and their properties used in design of machine 2-To calculate and understand the core design and main Dimension and cooling of transformer , induction machine and synchronous machine 3-To understand the performance characteristics of transformer, induction machine and synchronous machine
Course Outcomes	Students will be able to 1-Select proper material for design of a machine 2-Design a overall transformer and estimate its performance characteristics as per requirement and constraints specified 3-Utilize the knowledge of induction motor design to analyze the performance characteristics of motor 4-Implement the knowledge acquired to design the synchronous machine and 5-Analyze the performance characteristics.
Pre-requisites	Basic Electrical Engineering, Electrical Machines-I, Electrical Machines-II
Course Type	***Program Core Course***
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1: Review of Materials used in the construction of electrical machines							
Classification of insulating materials depending upon permissible temperature rise, properties of transformer oil. Standard specification, C.M.R. and short time rating of machines. Heating and cooling characteristics	***CO1***	***PO1 PO4 PO5***	***PSO2***	***1.2 4.3 5.1***	***1.2.1 4.3.2 5.1.1***	***Smart Room Teaching, Industrial Visits, Field Exercise***	
Unit 2: Transformer Design							
Specific loading, equation for voltage per turn for power and distribution transformer output equation.	***CO2 CO5***	***PO3 PO4 PO5***	***PSO3***	***3.2 4.1 5.2***	***3.2.2 4.1.2 5.2.1***	***Peer to Peer, Action Learning, Designing Software***	
Unit 3: Transformer Design (Contd.)							
Principal of electric and magnetic circuit design, method of cooling and cooling circuit design. Estimation of performance characteristics from the design data	***CO2 CO5***	***PO4 PO5***	***PSO3***	***4.1 5.2***	***4.1.2 5.2.1***	***Case study, Value Addition Course, Group Assignments***	

Unit 4: Induction Motor Design							
Main dimensions, output equation, loading constant estimation of axial lengths, air gap diameter, winding design. .	***CO3 CO5***	***PO2 PO4 PO5***	***PSO3***	***2.3 4.1 5.2***	***2.3.1 4.1.2 5.2.1***	***Simulation, Value Addition Course, Group Assignments, Designing Software***	
Unit 5: Induction Motor Design (Contd.)							
Air gap length, slot combination for stator and rotor of I.M., cage rotor and wound rotor design, calculation of on load current and performance on characteristics of design data	***CO3 CO5***	***PO2 PO4***	***PSO3***	***2.3 4.1***	***2.3.1 4.1.2***	***Smart Class Room Teaching, Group Assignments and Discussions, Designing Software***	
Unit 6: Synchronous Motor Design							
Air gap length, methods of obtaining sinusoidal O/P voltage, field coil design for salient pole machine and for turbo generator rotor, ventilation of synchronous generator, cooling air circuits, closed ventilation / quantity of cooling medium hydrogen and water as cooling media.	***CO4 CO5***	***PO2 PO3 PO5***	***PSO3***	***2.1 3.2 5.2***	***2.1.1 2.1.2 3.2.2 5.2.1***	***Smart Class Room Teaching, Peer to Peer***	

Text Books:

1. "Electrical Machine Design", A. K. Sawhney, Dhanpatrai & Sons, Delhi Pbs
2. "Electrical Machine Design", Balbir Singh, Dhanpatrai & Sons, Brite Students Publications, Pune
3. "Electrical machine Design", M. V. Deshpande

Reference Books:

1. "Performance and Design of A.C. Machines", M. G. Say, CBS Pbs.
2. "Power Transformer", S. B. Vasntinsky, P. S. G. College of Technology, Coimbatore
3. "Principle of Electrical Machine Design", R. K. Agrawal, S. Chand Pbs

E-sources:

1. NPTEL course on "Electrical Machine Design"
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-685-electric-machines-fall-2013/index.htm

Activity:

The course includes a Mini Project where students would get an opportunity to design single phase transformer of various rating in AUTOCAD and build the same to analyze its performance characteristics. Students would work in open lab model wherein they can work in any laboratory without time restrictions.
Student will build a working model which will be discussed weekly in tutorial session and final assessment would be done at the end of semester.

Course Code: 20UEE604E	*Energy Conservation & Audit*	*Total credits: 03*
Teaching Scheme		*Evaluation Scheme*
Theory :3-Hrs/week		*CA: 20 Marks*
Tutorial: --Hr/week		*Mid Sem: 30 Marks*
		End Sem: 50 Marks

Course Objectives	1. To understand the importance of energy management and audit. 2. To study various types of energy dissipating elements in electrical system. 3. To understand energy audit processes of these systems used in the industry. 4. To understand commercial & financial aspects.
Course Outcomes	Students will able to 1. Gain the knowledge about various types of energy related rules. 2. Gain knowledge about various types of electrical systems & losses occurring in electrical systems. 3. Get knowledge of different energy audit. 4. become aware about the Energy and load management. 5. Gain knowledge on various financial terms.
Pre-requisites	Fundamentals of Electrical Machines, Power System
Course Type	***Program Elective subject***
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	****Teaching Methodology***	***CO Mapping***	***Competency***	***PI***
UNIT:1 Energy Scenario:						
Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act-2001 and its features.	***PO1, PO2,PO3 PO4 PO 6***	***PSO1***	***Explanation by Qualitative Discussion & PPT***	**CO 1**	**1.3 2.1 3.1 4.1 6.2**	**1.3.1 2.1.1 3.1.4 4.1.1 6.2.1**
Unit:2: Electrical System I:						
Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues	***PO1, PO2,PO3 PO4***	***PSO1***	***Explanation by Qualitative Discussion *Problem Based *PPT***	**CO 2**	**1.3 2.1 3.1 4.1**	**1.3.1 2.1.1 3.1.4 4.1.1**
Unit 3: Electrical System II						
Energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues	***PO1, PO2,PO3 PO4***	***PSO1***	***Explanation by Qualitative Discussion *Problem Based *PPT***	**CO 2**	**1.3 2.1 3.2 4.1**	**1.3.1 2.1.1 3.2.1 4.1.1**

Unit 4: Industrial System						
Types of boilers, Combustion in boilers, Performances evaluation, Feed water treatment, Blow down, Energy conservation opportunities in boiler. Properties of steam, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Identifying opportunities for energy savings. Classification, General fuel economy measures in furnaces, Excess air, Heat Distribution, Temperature control, Draft control, Waste heat recovery.	***PO1, PO2,PO3 PO4***	***PSO1***	***Explanation by Qualitative Discussion *Problem Based *PPT***	**CO 1 CO 2**	**1.3 2.1 3.2 4.1**	**1.3.1 2.1.2 3.2.1 4.1.1**
UNIT-5: Energy Audit: Definition, Energy audit-						
need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution.	***PO1, PO2,PO3 PO4,PO5***	***PSO1***	***Explanation by Qualitative Discussion *Problem Based *PPT***	CO 5	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.1 3.1.4 4.1.1 5.1.1**
UNIT-6: Financial Management:						
Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.	***PO1, PO2,PO3 PO4,PO5***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	CO 5	**1.3 2.1 3.1 4.1 5.1**	**1.3.1 2.1.1 3.1.4 4.1.1 5.1.1**

Text Book:

1. Capehart, Turner and Kennedy, 'Guide to Energy Management', CRC Press, Taylor & Francis Group, 2008.

Reference Books:

1. Y.P. Abbi and S. Jain, 'Handbook on Energy Audit and Environment Management', T E R I Press, 2006.
2. Doti Steve, PE, CEM, 'Commercial Energy Auditing Reference Handbook', CRC Press, Taylor & Francis Group, 2010.
3. Desai Sonal, 'Handbook of Energy Audit', McGraw Hill Education, New Delhi, 2017.
4. Al-Shemeri Tarik, 'Energy Audits, A Workbook for Energy Management in Buildings', John Wiley & Sons, 2011.
5. G.G. Rajan, Optimizing energy efficiencies in industry -, Tata McGraw Hill, Pub. Co., 2001.
6. IEEE recommended practice for energy management in industrial and commercial facilities,

***E-sources*:** NPTEL course on " Energy Management"

Course Code : 20UEE605E	Industrial Management	Total credits:02
Teaching Scheme		Evaluation Scheme
Theory : 2Hrs/week		CA: 20 Marks
Tutorial: 00Hr/week		Mid Sem: 20 Marks
		End Sem: 60 Marks

Course Objectives	1. To understand various fundamental disciplines of management like personnel management, marketing management, financial management etc. 2. To apply this basic knowledge to understand the working of corporate world.
Course Outcomes	Students will be able to 1. Demonstrate project management skills. 2. Develop understanding of personnel management. 3. Demonstrate understanding of material and financial management. 4. Understand and apply maintenance management. 5. Understand and apply industrial safety. 6. Analyze and utilize the Resource Management.
Pre-requisites	
Course Type	Humanities and Social Sciences Including Management
Course Contents	

Unit No.	CO Mapping	PO Mapping	PSO Mapping	Competency	PI	*Teaching Methodology	Remark
Unit 1: Industrial Management: Principles and Importance of management, Functions of management, Decision making process. Principles of management: Concepts of management, development of scientific management, principles of Fredric Taylor & functions such as planning organizing, staffing, leading motivating, communicating, controlling, decision making, span of control.	CO1,CO2	PO1,PO2 &PO4	PSO1 & PSO2	1.1,1.2,2.1, 2.2,4.1	1.1.1,1.1.2, 1.2.1,2.1.1, 4.1.1,4.1.2	Interactive Teaching and ICT	
Unit 2: Personal management: Meaning, functions of personal management, manpower planning, collective bargaining, wages & salary dministration, labor welfare, training, trade unions, industrial factories Act, industrial boilers Act, Trade union act. salary and wage administration. Human Resource Management: Concept, Objective and Functions of HRM, Principles of good HR policy, Incentives: types and characteristics.	CO2,CO3	PO2 &PO4	PSO1 & PSO2	2.1,2.2,4.1, 4.3	2.1.2,2.1.3, 2.2.1,4.1.2, 4.1.3,4.3.2, 4.3.3	Interactive Teaching and ICT	
Unit 3: Plant management: Plant location, plant layout, types of maintenance such as break down, predictive & preventive maintenance,	CO2,CO3,CO4,CO5	PO1& PO2	PSO1 &PSO2	1.2,1.3,2.2	1.1.2,1.2.1, 1.3.1,2.1.2,	Interactive	

stores of management, industrial safety, causes & cost of accidents, safety programs, production planning & control, job, batch & process type of production concept, production planning and control, manufacturing systems: types and characteristics, plant layout types, need and characteristic.					***2.2.1***	***Teaching and ICT***	
Unit 4 : Material management: Importance of material management, classification, codification, forecasting, necessity of inventory Material requirement planning. Total Quality Management: Definition, Quality obstacles, Benefits of TQM,ISO registration benefits, ISO 9000 series standards, sector specific standards, ISO 9001requirements, Introduction to ISO 14000 series, Testing standards.	***CO3,CO4,CO5,CO6***	***PO2,PO4 &PO5***	***PSO1 & PSO2***	***2.2,2.3,4.1, 5.1***	***2.2.2,2.2.3, 2.3.2,4.1.2, 5.1.1***	***Interactive Teaching and ICT***	
Unit 5: Industrial Acts: Indian factory act, Indian Electricity act, The Workmen's compensation act, Consumer Protection act. Engineering Economics: Meaning of economics, difference between value and price, law of demand and supply, demand forecasting methods, Banks: functions and types, RBI, SEBI, modern concepts like SEZ, PPP, BOT.	***CO3,CO4,CO5***	***PO2 ,PO4 &PO5***	***PSO1 & PSO2***	***2.2,4.1 ,5.1, 5.2***	***2.2.2,2.2.4, 4.1.1,4.1.2, 5.1.2,5.2.1***	***Interactive Teaching and ICT***	
Unit 6: Management Information Systems: Introduction, Elements, Structure and Requirements of MIS, Decision support system. Operations Research: LPP (Graphical only), Transportation Problem, Assignment Problem, Inventory Model (EOQ, Stock levels).	***CO3,CO4***	***PO2 ,PO4 &PO5***	***PSO1 &PSO2***	***2.2,2.3 ,4.2, 5.2***	***2.2.3,2.2.4, 2.3.2,4.2.1, 5.2.1***	***Interactive Teaching and ICT***	

Text Books:

1. Industrial Engineering and Management: O.P. Khanna; Dhanpatrai and Company
2.Total Quality Management by D.H. Besterfield, C.B. Michana& others; PHI Pvt. Ltd.
3.Kotler P., Stauton "William Principles of marketing management", Prentice Hall, 1985.

Reference Books:

1. ISO 900 quality systems: A. N. Singh; Dolphin Book N Delhi.
2.S.C. Kuchal, "Financial Management", Chaitanya Publishing House

***E-sources*:** 1.Online MOOC course material in SWAYAM and NPTEL.

Course Code: 20UEE606E	***Computer Network***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
		Mid Sem: 20Marks
Theory: 03 Hrs/week		***Simulation Assignment: 20 Marks***
Tutorial:		***End-Semester: 60***

Course Objectives	1. To acquire the knowledge of Computer Network. 2. To understand major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs). 3. To analyse the working of wireless Protocol & apply WLAN measurement ideas.
Course Outcomes	Students will be able to 1. Acquire the knowledge of Computer Network. 2. Understand major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs). 3. Analyze the working of wireless Protocol. 4. Apply WLAN measurement ideas. 5. Knowledge of working of internet.
Pre-requisites	Basic Knowledge of Communication and computer hardware.
Course Type	***Professional Elective course***

Course Contents

Unit No	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	****Teaching Methodology***	***Remark***
Unit 1: Physical Layer							
Physical Layer Data Communications, Networks, Network types, Protocol layering, OSI model, Layers in OSI model, TCP / IP protocol suite, and Addressing, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching, Structure of a switch.	***CO1***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator,***	
Unit 2: Data Link Layer							
Introduction to Data Link Layer, DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Giagabit Ethernet, 10 Gigabit Ethernet.	***CO1***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator, Activity Based***	

Unit 3: Wireless LANS & Virtual Circuit Networks							
Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, LoRa, connecting devices and Virtual LANS: Connecting devices, Virtual LANS	***CO1 CO2 CO3***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator, Activity Based***	
Unit 4: Network Layer							
Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP– Delivery, Forwarding and Unicast Routing protocols.	***CO2 CO3***	***PO1,2***	***PSO1, PSO2***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator, Activity Based***	
Unit 5 Transport Layer							
Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	***CO2 CO3***	***PO1,2***	***PSO1, PSO2***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator, Activity Based***	
Unit 6 Application Layer							
Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography	***CO2 CO3***	***PO1,2***	***PSO1, PSO2***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator, Activity Based***	

Textbooks:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. TCP/IP Protocol Suite, 4th Edition, Behrouz A. Forouzan, Tata McGraw-Hill.

Reference Books:

1. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
2. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

E-sources:

1. ***https://www.nptel.ac.in › courses***
2. ***https://www.coursera.org › courses***

Course Code: 20UEE608D	Industrial Automation	Total credits: 03
Teaching Scheme		Evaluation Scheme
Theory : 3Hrs/week		CA: 20 Marks
Tutorial:00 Hr/week		Mid Sem: 20 Marks
		End Sem: 60 Marks

Course Objectives	1. Understand basic concepts of Automation. 2. To understand Automation application in industries. 3. To study SCADA system and its applications in power system 4. Implementation of various PLCs for Automation problems in industries.
Course Outcomes	Students will be able to 1. Understand and apply the knowledge of automation and its effect on manufacturing. 2. Analyze Automation as a tool for quality performances in Industry. 3. Design and develop basic programming for PLC as a controller. 4. Conduct investigation of complex problem using modern tool of SCADA and its necessity. 5. Create communication between I/O and PLC to develop a controller. 6. Understand and analyze the DCS for project management.
Pre-requisites	Basic Measurement loops.
Course Type	

Course Contents

Unit No.	*CO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PteI*	*Teaching Methodology*	*Remark*
Unit 1 : Automation:							
Benefits and Impact of Automation on Manufacturing and Process Industries, Architecture of Industrial Automation Systems. Data Acquisition systems and PC based automation.	***CO1, CO2***	***PO1, PO2, PO3***	***PSO1 ,PSO 2***	***1.1,2. 1,3.1***	***1.1.2, 2.1.2, 3.1.3***	***Interactive Teaching and ITC***	
Unit 2: Machine Automation							
Machine & Equipment Automation, Process Automation and its needs, Manually operated/Semi-automatic/Fully Automatic, Importance of Control Systems. Components of control. Explanation with the help of liquid level control system. Significance of actuators and sensors. Types of actuators, Types of sensors. Open loop control and closed loop control. Use of relays, switches and cont actors in developing simple and sequential control system.	***CO1, CO2, CO3***	***PO2, PO3, PO4, PO5***	***PSO1 ,PSO 2,PS O3***	***2.2,3. 2,4.1, 5.1***	***2.2.1, 2.2.2, 3.2.1, 4.1.2, 5.1.1***	***Interactive Teaching and ITC***	
Unit 3:Basics of PLC and its application							
Process control, components and systems, ladder logic design, programming, memory system and analog and discrete Input / Output system, practical control system implementation for electrical application.	***CO2, CO3, CO4***	***PO3 ,PO 4,P O5, PO9 ,PO 10***	***PSO1 &PSO 2***	***3.1, 3.2, 4.1, 5.1, 9.1, 10.1***	***3.1.3, 3.2.24 .1.2,5. 1.29.1 .1, 10.1.2***	***Project learning and ITC teaching***	

Unit 4:SCADA Hardware							
Hardware Architecture, Properties and Functions of Software, Configuration of SCADA system. SCADA Applications: Operation and control of interconnected power system, Automatic substation control, Conventional Electric Power Generation, Transmission and Distribution sector operation.	***CO3, CO4***	***PO2 ,PO 3,P O4, PO5 ,PO 9 ,PO 10***	***PSO1 PSO2, PSO3***	***2.1, 3.2, 4.2, 5.1 9.1, 10.1***	***2.1.3, 3.2.1, 4.2.1, 5.1.2, 9.1.1, 10.1.2 ,10.1. 3***	***ITC and Interactive teaching***	
Unit 5:Distributed Control System							
Introduction and overview, history, system architecture, system elements, communication links and its difference. Compares ion of centralized and distributed control system.	***CO3, CO4, CO5, CO6***	***PO2 ,PO 3,P O5, PO9 ,PO 10, PO1 1***	***PSO2, PSO3***	***2.2, 3.1, 5.1, 9.2, 10.1 ,11. 1***	***2.2.2, 2.2.33 .1.3,5. 1.19.2 .1, 10.1.2 , 11.1.1***	***ITC and Interactive teaching***	
Unit6 : Displays							
group display, overview display, detail display, local control units, mean time between failures, data Highways, field buses, multiplexers and remote sensing terminal units, I/O hardware, study of any one DCS.	***CO2, CO3***	***PO2 ,PO 3,P O4, PO5 ,PO 8***	***PSO1 PSO2***	***2.1, 3.1, 4.1, 5.2, 8.1***	***2.1.2, 3.1.3 4.1.3, 5.2.1, 8.1.1***	***ITC and Interactive teaching***	

Text Books:

1. “Process Control”, Peter Harriot, Tata McGraw-Hill.
2. “Process System analysis and Control”, Donald R. Coughnour, McGraw-Hill, 1991.
3. “Programmable Logic Devices and logic Controllers”, Enrique Mandado, Jorge Marcos and Serafin A Perrez, Prentice-Hall, 1996.
4.“Distributed Computer Control for Industrial Automation”, Dobrivoje Popovic, Vijay P Bhatkar, Marcel Dekker INC, 1990.
5. Stuart A Boyer: SCADA supervisory control and data acquisition.
6. M. Lucas: Distributed Control Systems.

Reference Books:

1. B. G. Liptak, Instrument Engineer's Handbook, Process Control, Third Edition, Chilton Book company, 1996.
2) C. D. Johnson, Process Control Instrumentation technology, Prentice- Hall of India, 1993.
3)Hughes: Programmable Controllers, ISA Publications, 1989.
4) Stuart A Boyer: SCADA supervisory control and data acquisition. 5)M. Lucas: Distributed Control Systems.

E-sources**:** 1.ISA Website
2. www.texas Instruments

Course Code : 20UEE609H	***Constitutional Literacy***	***Total credits: 01***
Teaching Scheme		***Evaluation Scheme***
	CA :	
Theory: 02Hrs/week	***Mid sem:***	
Tutorial: -Hr/week	***End-Semester : 50 Marks***	

Course Objectives	1. The objective of the subject is how to deal and adjust in the society under government regulations. 2. To make governance better an engineer must conduce to E-governance through computers and knowledge of cyber laws. An engineer must know the limits of state action and regulations by acquainting himself with the laws that applied by the bureaucrats.
Course Outcomes	At the end of the syllabus, 1.To develop the understanding of thesubject. 2..This subject acquaints students with the constitutional design of state structures and institutions, and their actual working over time. 3. The subject traces the embodiment of some of these conflicts in constitutional provisions, and shows how these have played out in political practice.
Pre-requisites	
Course Type	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge].
Course Contents	

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1:**Constitution – Structure and Principles**							
Meaning and importance of Constitution, Making of Indian Constitution – Sources, Salient features of Indian Constitution , Role of Public Sector Undertakings in economic development, Public policy making in India and influence of new globalised world order Act :Cyber laws in India , E-Governance and role of engineers in E-Governance.	***CO 1,CO2***	***1,2***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture and ICT***	
Unit 2:**Fundamental Rights and Directive Principles**							
Fundamental Rights , Fundamental Duties Directive Principles,Citizenship- Methods of acquiring and loosing, Fundamental Rights and Directive Principles of State Policy.	***CO 2,CO3***	***1,2***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture***	
Unit 3:**Government of the Union**							
President of India – Election and Powers , Prime Minister and Council of Ministers . Lok Sabha – Composition and Powers, Rajya Sabha – Composition and Powers Government of the States, Governor –	***CO 3***	***1,2,6***	***PSO1***	***1.1,2.1,6.1***	***1.1.1, 2.1.1, 6.1.1***	***Lecture and ICT***	

Powers , Chief Minister and Council of Ministers , Legislative Assembly – Composition and powers ,Legislative Council – Composition and powers, Federalism in India – Features , Local Government - Panchayats –Powers and functions, Election Commission – Organisation and functions , Citizen oriented measures – RTI and PIL – Provisions and significance							
Unit 4:**The Judiciary**							
Features of judicial system in India , Supreme Court –Structure and jurisdiction ,High Court – Structure and jurisdiction , Administrative organisation and constitution,State Judiciary: Powers References, Role of I.T. professionals in Judiciary.	***CO 2***	***1,2,6***	***PSO1***	***1.1,2.1,6.1***	***1.1.1, 2.1.1, 6.1.1***	***Lecture***	
Unit 5:**Policy of Industrialization in India**							
Role of Planning Commission in economic development, Finance Commission and centre-State relations, Directive Principles of State Policy, Politics of Industrialization in India and the policy of Liberalization Privatization and Globalization (LPG), Need for reformed engineering serving at the Union and State level, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development	***CO 2,CO3***	***1,2,2.1***	***PSO1***	***1.1,2.1***	***1.1.1, 2.1.1***	***Lecture***	

Text Books :

2. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)
3. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)
4. Cyber Law by Dr. Gupta and Agarwal.
5. Public Administration by Awasthi and Maheshwari

Reference Books :

1. Constitutional Questions in India: The President, Parliament and the States, A. G. Noorani, Oxford University Press, Delhi, 2000.
2. Indian Political System, J.C. Johari, Anmol Publishers, New Delh,1996.
3. Constitutional Development and National Movement in India, V.D. Mahajan, S. Chand and Co, New Delhi, 1986.

E-Resources :

2. www.indiancourts.nic.in
3. Constitution of India (Full Text), India.gov.in.,
4. National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf 5

Course Code: : 20UEE610L	*Power Electronics LAB*	*Total credits :04*
Execution Scheme	*Computer Lab / Power Electronics LAB*	*Evaluation Scheme*
Practical : 02 Hrs/week		*Term work: 25* *VIVA : 50* *Simulation :25*

Lab outcomes	*1. Evaluation of the V-I characteristics, turn-on and turn-off methods for different power semiconductor switches.* *2. Understanding operation and control techniques of power converters.* *3. Analysing waveforms exhibited at the input and output ports of the converters.* *4. Measurement of input and outputs of converters and analysing them in light of the respective theories.* *5. Simulation and modelling of converters can be perform.*

Course Contents

Sr	*Name Of Practical*	*Type/ Methodology*	*CO Mapping*	*PO Mapping*	*PSO Mapping*	*Compe-tency*	*PI*
1.	*SCR Characteristics*	*Performance*		*PO2,3*	*PSO1,2,3*	*2.7* *3.7*	*2.7.1* *3.7.1*
2.	*SCR turn on methods*	*Performance*		*PO2,3*	*PSO1,2,3*	*2.7* *3.7*	*2.7.1* *3.7.1*
3.	*SCR Commutation Methods*	*Performance*		*PO2,3*	*PSO1,2,3*	*2.7* *3.7*	*2.7.1* *3.7.1*
4.	*IGBT/MOSFET Characteristics, Drivers*	*Performance*		*PO2,3*	*PSO1,2,3*	*2.7* *3.7*	*2.7.1* *3.7.1*
5.	*Single Phase Controlled Converter*	*Performance*		*PO4,5*	*PSO1,2,3*	*4.6* *5.6*	*4.6.1* *5.6.1*
6.	*Three Phase Controlled Converter*	*Performance*		*PO4,5*	*PSO1,2,3*	*4.6* *5.6*	*4.6.1* *5.6.1*
7.	*D.C. Chopper*	*Performance*		*PO4,5*	*PSO1,2,3*	*4.6* *5.6*	*4.6.1* *5.6.1*
8.	*Single Phase Inverter*	*Performance*		*PO4,5*	*PSO1,2,3*	*4.6* *5.6*	*4.6.1* *5.6.1*
9.	*Three Phase Inverter*	*Performance*		*PO4,5*	*PSO1,2,3*	*4.6* *5.6*	*4.6.1* *5.6.1*
10.	*PWM Inverter*	*Performance*		*PO4,5*	*PSO1,2,3*	*4.6* *5.6*	*4.6.1* *5.6.1*

Course Code: 20UEE611L	*Electrical Machine Design Lab*	*Total credits: 01*
Execution Scheme		*Evaluation Scheme*
Practical : 2 Hrs/week		*CA: 60 Marks* *End sem Exam : 40 Marks*
Lab Outcomes	*1-Student will be able to learn the basic commands of AUTOCAD.* *2- Student will be able to design various types of windings in AUTOCAD. 3- Student will be able to design transformer, induction and synchronous machine.*	
Course Contents		

Name of Practical	*LO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	**Type/Methodology*	Remark
Experiment 1: Introduction to AUTOCAD and its basic commands	*LO1*	*PO1*	*PSO1*	*1.3*	*1.3.1*	*Designing using AUTO CAD*	
Experiment 2: Design Single Layer and Multi-Layer Winding	*LO1*	*PO2*	*PSO1*	*2.1*	*2.1.2*	*Designing using AUTO CAD*	
Experiment 3: Design Lap and Wave Winding	*LO1*	*PO2* *PO4*	*PSO1*	*2.1* *4.1*	*2.1.2* *4.1.1*	*Designing using AUTO CAD*	
Experiment 4: Design core and winding of Transformer	*LO2*	*PO2* *PO4*	*PSO1* *PSO2*	*2.3* *4.2*	*2.3.1* *4.2.1*	*Designing using AUTO CAD*	
Experiment 5: Design of stator and rotor of Induction Motor	*LO2*	*PO1*	*PSO1* *PSO2*	*1.3*	*1.3.1*	*Designing using AUTO CAD*	
Experiment 6: Design Synchronous Machine	*LO3*	*PO2*	*PSO1*	*2.3*	*2.3.1*	*Designing using AUTO CAD*	
Experiment 7 : Design of Equivalent Circuit all Electrical Machines	*LO3*	*PO2* *PO4*	*PSO1*	*2.3* *4.1*	*2.3.1* *4.4.1*	*Designing using AUTO CAD*	

Course Code: : 20UEE612L	*Industrial Automation Lab*	*Total credits: 01*
Execution Scheme		*Evaluation Scheme*
Practical : 2 Hrs/week		*CA: 60 Marks* *End Sem: 40 Marks*

Lab outcomes			*1. To understand the basic concepts of Automation.* *2. To understand and analyze the various I/O devices.* *3. To understand PLCs.* *4. To develop PLC programming and implement it.* *5. To understand the SCADA & DCS.*			
Course Contents						

Name Of Practical	*LO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Type/Methodology*
1.To study.PLC supply, input, output wiring scheme development & testing	*LO1,LO2,LO3*	*PO1*	*PSO1*	*1.1*	*1.1.1*	*Observation and understanding*
2. Study of digital inputs, outputs, Analog Inputs, outputs of PLC.	*LO1,LO2*	*PO1*	*PSO1*	*1.1*	*1.1.1*	*Observation and understanding*
5. Basic Ladder Diagram logic programming	*LO2,LO3,LO4*	*PO1 ,PO2,PO3*	*PSO1 &PSO2*	*1.1,2.1,3.1*	*1.1.1,2.1.1, 2.1.2,3.1.1*	*Development and Implement ion*
6. To write and ex cute ladder diagram for logic gates	*LO2,LO3,LO4*	*PO1 , PO2 ,PO4*	*PSO1 &PSO2*	*1.2,1.3,2.1, 4.1,*	*1.2.1,1.3.1, 2.1.1,4.1.1*	*Development and Implement ion*
4.To develop Timer function & implementation in application	*LO2,LO3,LO4*	*PO1 , PO2,PO5*	*PSO1 ,PSO2,PSO3*	*1.2,1.3,2.1, 5.1*	*1.2.1,1.3.1, 2.1.1,5.1.2*	*Development and Implement ion*
5.To develop Counter function & implementation in application	*LO2,LO3,LO4*	*PO1 ,PO2,PO5*	*PSO1 ,PSO2,PSO3*	*1.2,2.1,5.2*	*1.2.1,2.1.2, 5.2.1*	*Development and Implement ion*
6. To study SCADA for electrical power applications.	*LO5*	*PO1 ,PO2*	*PSO1,PSO2,PSO3*	*1.2,2.1*	*1.2.1,2.1.1*	*Understand and observe*
7. To develop motor start and stop circuit operation by PLC.	*LO2,LO3,LO4*	*PO1 ,PO2.PO3*	*PSO1 PSO2,PSO3*	*1.2,1.3,2.1, 3.1*	*1.2.1,1.3.1, 2.1.2,3.1.2*	*Development and Implement ion*

Course Code : 20UEE613P	***Project Part I***	***Total credits: 01***
Teaching Scheme		***Evaluation Scheme***
		CA : -Marks
Project Hrs : 02 Hrs/week		***Mid sem: -Marks***
		End-Semester : 60 Marks

Course Objectives	1. To inculcate culture of handling all aspects of solution of a practical problem 2. To develop ability to work in group with peers. 3. To understand, formulate and analyze the problem resulting into a novel solution.
Course Outcomes	Students will be able 1. to handle all aspects of solution of a practical problem. 2. to work in group with peer 3. to obtain novel solution by understanding, formulating and analyzing the problem.
Pre-requisites	***Electrical Engineering Courses***
Course Type	***Project***

Course Contents

1.Initiate the work on the topic in areas of electrical and electronics engineering as proposed by Project supervisor in terms of following
2. Literature Survey
3. Problem Definition
4. Preliminary investigation
5. Prepare plan of action based on above
6. Present seminars based on the work done at end of semester.

SEMESTER VII

Course Code :20UEE701D	*Electrical Drives*	*Total credits: 04*
Teaching Scheme		*Evaluation Scheme*
		Quiz/Assignment/Case study : 30 Marks
Theory : 03 Hrs/week		*Project: 30 Marks*
Project : 02Hr/week		*End-Semester Exam: 40*

Course Objectives	4. To provide fundamental knowledge in dynamics and control of Electric Drives. 5. To justify the selection of Drives for various applications. 6. To familiarize the various semiconductor controlled drives employing various motors
Course Outcomes	The Students will be able to 6. To understand integration of Power electronics and Electrical Machines. 7. To select a drive for a particular application. 8. To familiarize with the various control techniques employed for controlling drives with ac and dc. 9. To analyze transfer functions of various drive system. 10. To design close loop and open loop drive systems.
Pre-requisites	Electrical Machines, Power Electronics & Control System
Course Type	**1 – Program Core Course**
Course Contents	

Unit No.	*CO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Teaching Methodology*	*Remark*
Unit 1: Introduction to Electrical Drives							
Definition, Advantages of electrical drives, Components of Electric drive system, Selection Factors, status of Electrical Drives (DC & AC), speed control and drive classifications, close loop control of drives, phase locked loop (PLL) control..	*CO1* *CO2*	*PO1* *PO2*	*PSO1*	*1.2* *1.5* *2.5*	*1.2.1* *1.5.1* *2.5.1* *2.5.3*	*Interactive teaching with the help of ICT*	
Unit 2 : Dynamics of Electrical Drives							
Motor-Load Dynamics, Speed Torque conventions and multi quadrant operation, Equivalent values of drive parameters. Load Torque Components, Nature and classification of Load Torques, Constant Torque and Constant Power operation of a Drive. Steady state stability, Load equalization. Selection of Motor Power Rating :Thermal model of motor for heating and cooling, classes of motor duty, determination of motor ratings.	*CO2* *CO5*	*PO1* *PO2* *PO5*	*PSO1*	*1.2* *1.5* *2.6* *5.4* *5.5*	*1.2.1* *1.5.1* *2.6.1* *5.4.1* *5.5.2*	*Interactive teaching with the help of ICT*	
Unit 3 : DC Drives							
Dc motors and their performance starting, transient analysis, speed control, ward Leonard drives, Controlled rectifier fed drives, [full controlled3 phase rectifier control of dc separately excited motor], multi-quadrant	*CO3* *CO5*	*PO1* *PO2* *PO3* *PO4* *PO5*	*PSO1* *PSO2*	*1.2* *1.5* *3.5* *4.4* *5.6*	*1.2.2* *1.5.3* *3.5.1* *4.4.3* *5.6.1*	*Interactive teaching with the help of ICT*	

operation, Chopper controlled drives Closed loop speed control of DC motor.							
Unit 4: AC Drives							
Induction motor analysis, starting and speed control methods- voltage and frequency control, current control, closed loop control of induction motor drives, rotor resistance control, Slip-power recovery – Static Kramer and Scherbius Drive, Single phase induction motor starting, braking and speed control.	***CO5*** ***CO2***	***PO1*** ***PO2*** ***PO3*** ***PO5***	***PSO1*** ***PSO2***	***1.2*** ***1.5*** ***2.6*** ***3.5*** ***5.5***	***1.2.1*** ***1.5.1*** ***2.6.1*** ***3.5.15.*** ***5.1***	***Interactive teaching with the help of ICT***	
Unit 5: Synchronous Motor Drives							
Synchronous motor types, operation with fixed frequency, variable speed drives,	***CO3*** ***CO5***	***PO1*** ***PO3*** ***PO4***	***PSO2*** ***PSO3***	***1.2*** ***1.5*** ***2.6*** ***4.5***	***1.2.1*** ***1.5.1*** ***2.6.1*** ***4.5.1***	***Interactive teaching with the help of ICT***	
Unit 6: Brushless Motor Drives							
PMAC and BLDC motor drives, Stepper motor drives, switch reluctance motor drives.	**CO4** **CO5**	***PO1*** ***PO3*** ***PO5***	***PSO1*** ***POS3***	***1.2*** ***1.5*** ***3.7*** ***5.5***	***1.2.1*** ***1.5.1*** ***3.7.1*** ***5.5.4***	***Interactive teaching with the help of ICT***	

Text Books :

4. G. K. Dubey, “Fundamentals of Electrical Drives”, Second edition (sixth reprint), Narosa Publishing house.
5. Bimal K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education

Reference Books :

4. M. H. Rashid, “Power Electronics -Circuits, devices and Applications”, 3rdEdition, PHI Publication.
5. Werner Leonhard, “Control of Electrical Drives”, 3rd ed., Springer, 2001
6. Theodore Wildi, “Electrical Machines, Drives and Power Systems”, sixth edition, Pearson

E-Resources :

4. https://nptel.ac.in › courses
5. https://ocw.mit.edu › courses

Course Code: 20UEE702D	Course Title	Total credits: 03
Teaching Scheme	**Switchgear and Protection**	**Evaluation Scheme**
Theory : 03 Hrs/week		**CA: 20 Marks**
Tutorial: 0 Hr/week		**Mid Sem: 20 Marks**
Practical : 02 Hrs/week		**End Sem: 60 Marks**

Course Objective	1. To introduce to power system protection and switchgear. 2. To teach students theory and applications of the main components used in power system protection for electric machines, transformers, bus bars, feeders and transmission lines. 3. To teach students the principle, operation construction and selection of different types of protective relaying, and circuit breakers 4. To acquire an ability and skill to design the feasible protection systems needed for each main part of a power system in students.
Course Outcomes	Student will be able to 1. Explain the working of different types of switchgear equipment's like circuit breakers and relays. 2. Elucidate various protection schemes of various power system components like electric machines, transformers, feeders, transmission lines, bus-bars. 3. Gain an ability to select and design a desired protective system. - How it works and where it works? 4. Gain an ability to identify various types of faults in Power system. Select suitable switchgears for different applications 5. Acquire skill and ability to do testing and maintenance of protective relaying
Pre-requisites	Electrical Power Transmission and Distribution, Power System Analysis
Course Type	Program Core Course

Course Contents

Unit No.	Co Mapping	PO Mapping	PSO Mapping	Competency	PI	Teaching Methodology	Remark
Unit1: Introduction to Protective Relaying *(06Hrs)*							
Importance of protective schemes for electrical apparatus and power system, basic requirements of protection system, zones of protection, classification of protective schemes, faults in power system, fault currents, fault clearing process, - relay terminology – definitions - and essential qualities of protective relaying	CO1	***PO1***	***PSO1***	1.2	1.2.1	Interactive classroom teaching (ICT) classroom teaching	
Unit 2: Relays *(07Hrs)*							
Classification of relays, construction, working principle, characteristics and application of electromagnetic relay, relay setting, different types of protective relays- over	CO1	***PO1***	***PSO1***	1.2	1.2.1	ICT, classroom teaching	

current relay, thermal relay, buchholz relay, electromagnetic attraction relay, electromagnetic induction relay , induction type earth fault relay, directional relay, distance relay, differential relay, Translay relay, negative phase sequence relay & introduction to static relay, classification and components of static relay.							
Unit 3: Protection Schemes AC generator and motor, transformer *(07Hrs)*							
General faults, stator and rotor protection, overload or over-current protection, over-voltage protection, over-speed protection, unbalanced loading protection, prime mover failure, restricted earth fault protection, Merz- price earth fault protection. Induction Motor Protection: Protective circuits for single phasing preventer, phase fault, ground fault, phase reversal protection. Transformer Protection: Buchholz protection, leakage protection, overload protection, differential protection of power transformer, Harmonic restraint relay, unrestricted earth fault protection, restricted earth fault protection, frame leakage protection, Merz-price protection	***C02,C03,C04***	***PO2***	***PSO1***	2.1	2.1.3	ICT, classroom teaching	
Unit 4: Protection of Bus-bar, feeders and Transmission Lines (*07Hrs)*							
Protection schemes for feeder, bus-bar & transmission lines using over-current, Differential, Distance (Impedance) protection and Carrier current protection. Protection against lighting: Protection of power station	***C02,C03,C04***	***PO2***	***PSO1***	2.1	2.1.3	ICT, classroom teaching	

& substation against direct lightning strokes, protection of transmission lines against direct lightning strokes, protection against traveling waves, surge arresters specifications and terms, types of lightning arresters: rod gap arrester, sphere gap arrester, horn gap arrester, multiple gap arrester, expulsion type arrester, surge capacitor, surge reactor and surge absorber.							
Unit 5: Circuit Breakers *(06Hrs)*							
Arc phenomenon- Arc extinction, Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers, MCB, ELCB, HVDC circuit breakers – comparative merits of different circuit breakers , testing of circuit breakers, selection of circuit breakers, standard rating	C01,C05	***PO2,PO3***	***PSO1***	2.1 3.1	2.1.3 3.1.1	ICT, classroom teaching	
Unit 6: Testing and maintenance of protective relays and Microprocessor Based Protective Relays *(6Hrs)*							
Testing and maintenance of protective relays: tests on relays, types of tests, test equipments, tests in CT's and PT's Microprocessor Based Protective Relays: Introduction, over current relays, Impedance relay, Directional relay, Reactance relay.	C05	***PO3***	***PSO2, PSO3***	3.1	3.1.1		

Text Books:

1. Switchgear & protection by Sunil S. Rao.
2. A course in electrical power by J.B.Gupta
3. Power system engineering by A.C. Chakrabarti, Soni-Gupta-Bhatnagar.
4. Power system protection & switchgear by Badriram, D.N. Vishwakarma.
5. Fundamentals of power system protection by V.G. Paithankar & S.R. Bhide.

Reference Books:

1. Switchgear & protection by Ravindranath & M. Chander.
2. The art & science of protective relaying by C.R. Mason.

E-sources:

1. NPTEL course on "Switchgear and Protection"

Course Code : 20UEE703D	*DIGITAL SIGNAL PROCESSING*	*Total credits: 04*
Teaching Scheme		*Evaluation Scheme*
		CA : 20 Marks
Theory : 03Hrs/week		*Mid sem: 20Marks*
Tutorial: -1Hr/week		*End-Semester : 60 Marks*

Course Objectives	**1.** To classify various signals & systems. **2.** To use various mathematical techniques for analysis of signals & systems . **3.** To prepare design steps of filters.
Course Outcomes	At the end of course, students will be able to, 1. To define & compare various signals. 2. To verify & compare various systems. 3. To apply the various methods for analysis signals 4. To apply the various methods for analysis systems. 5. To design & compare various filters.
Pre-requisites	Engineering Mathematics, Signals & Systems.
Course Type	***Engineering Science course***
Course Contents	

Unit No.	*CO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Teaching Methodology*	*Remark*
UNIT 1: Introduction to DSP							
*"*Elements of a Digital Signal Processing System, Advantages of Digital over Analog Signal Processing, Multichannel and Multidimensional Signals, Continuous-Time vs Discrete-Time Signals, Continuous-Valued Vs Discrete-Valued Signals, Deterministic vs Random Signals. Sampling of Analog Signals, the Sampling Theorem, Quantization of Continuous-Amplitude Signals, Quantization of Sinusoidal Signals.*"*	***CO1***	***PO1,2,12***	***PSO 1***	***1.6***	***1.6.1***	***ICT TOOLS***	
UNIT 2: Discrete Time signals & System							
*"*Classification & Manipulations of Discrete-Time Signals, Diagram Representation of Discrete-Time Systems, Classification	***CO2***	***PO1,2,12***	***PSO 1***	***2.1***	***2.5.1***	***ICT TOOLS***	

& Interconnection of Discrete-Time Systems, Analysis of Discrete-Time Linear Time-Invariant Systems, The Convolution Sum & its Properties, Stability of Linear Time-Invariant Systems, Recursive and Nonrecursive Discrete-Time Systems, Linear Time-Invariant Systems Characterized by Constant-Coefficient Difference Equations, Solution of Linear Constant-Coefficient Difference Equations, The Impulse Response of a Linear Time-Invariant Recursive System. ”							
UNIT 3: DTFT & Z-Transform							
Defination & propertiesof DTFT, relatioship with continuous Time Fourier Series (CTFS), Properties of Direct Z-transform, Inverse Z-Transform by Contour Integration, Inverse Z-Transform by Power Series Expansion, Inverse z-Transform by Partial-Fraction Expansion, Decomposition of Rational z-Transforms, Definition and Properties of One-sided Z-Transform, Solution of Difference Equations using Z-transform.”	***CO1,2,3***	***PO1,2,12***	***PSO 1***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	
UNIT 4: Discrete Fourier Transform(DFT)							
Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, Defination & relationship with DTFT, matrix representation, properties of DFT, Circular convolutoin &	***CO1,2, 4***	***PO1,2,3, 12***	***PSO 1 &2***	***1.6 2.7***	***1.6.1 2.7.1***	***ICT TOOLS***	

its releationship with linear convolution, Effect of zero padding,							
UNIT 5: Fast Fourier Transform(FFT)							
Introducton to Fast fourier Transform (FFT) algorithm, Decimation in time & frequency algorithms, Additional DFT Properties.*"*	***CO1,2, 5***	***PO1,2,12***	***PSO 1 &2.8***	***1.6 2.7***	***1.6.1 2.8.1***	***ICT TOOLS***	
UNIT 6: Implementation of Discrete- Time Systems							
Structures for the Realization of Discrete-Time Systems, Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure for FIR Systems, Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Latticc and Lattice-Ladder Structures for IIR Systems.*"*	***CO1,2,6***	***PO1,2,3,12***	***PSO 1***	***1.6 3.6***	***1.6.1 3.6.1***	***ICT TOOLS***	

Text Books:

1. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer, 3rd edition, 2010, Prentice Hall, Upper Saddle River, NJ.
2. N.G.Palan, "Digital Signal Processing"
3. .Ramesh Babu, "Digital Signal Processing"

Reference Books:

1. Digital Signal Processing by John G. Proakis and Dimitris K. Manolakis, 4th edition, 2007, Prentice Hall, Upper Saddle River, NJ.
2. Digital Signal Processing by Sanjit Mitra, 4th edition, 2011, McGraw-Hill, New York, NY.

E-sources:

1. Digital Signal Processing online course on www.arm.com
2. Digital Signal Processing online course on www.coursera.org
3. Digital Signal Processing NPTEL online course.

Course Code : 20UEE704D	***High Voltage Engineering***	***Total credits: 03***
Teaching Scheme		****Evaluation Scheme***
Theory : 3 Hrs/week		***CA: 20 Marks***
Tutorial: Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks

Course Objectives	1. To make students able to explain the various breakdown processes in solid, liquid and gaseous materials and describe Lightning phenomenon, natural cause of overvoltage in detail with formation of charge in clouds. 2. To provide sound knowledge of Testing, Generation & measurement methods of DC, AC and impulse voltages and current. 3. To develop ability to carry out various testing procedures as per IS in laboratory with knowledge of earthing, safety and shielding of HV laboratory.
Course Outcomes	Students will able to 1. Reproduce concepts of breakdown phenomenon of solid, liquid and gaseous materials 2. Gain knowledge of different types of insulating materials 3. List and reproduce various methods of generation and measurement of DC, AC and impulse high voltage. 4. Demonstrate an ability to carry various DC. AC and impulse testing on high voltage equipments and materials. 5. Apply safety measures, earthing, shielding for layout of HV apparatus required in High voltage laboratory..
Pre-requisites	Fundamentals of Electromagnetics, Electric Power systems, Electrical Measurements
Course Type	***Program Core subject***

Course Contents						
Unit No.	***PO Mapping***	***PSO Mapping***	****Teaching Methodology***	***CO Mapping***	***Competency***	***PI***
UNIT:1 Introduction						
Conduction and Breakdown in Gases, in Liquid Dielectrics, in Solid Dielectrics	PO1	PSO1	Explanation by Qualitative Discussion & PPT	CO 1	1.3	1.3.1
UNIT 2 Applications of insulating materials						
In transformers, rotating machines, circuit breakers, cable power capacitors and bushings.	PO 1	PSO 1	Explanation by Qualitative Discussion & PPT	CO 2	1.3	1.3.1
UNIT 3:Generation of High Voltages and Currents:						
Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators	PO1 PO2	PSO1	Explanation by Qualitative Discussion & PPT	CO 3	1.3 2.1	1.3.1 2.1.1
UNIT 4:Measurement of High Voltages and Currents:						
Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and	PO1 PO4	PSO1	Explanation by Qualitative Discussion	CO 3	1.3 4.1	1.3.1 4.1.2

Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.			& PPT			
UNIT-5:Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems:						
National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems	PO1 PO4	PSO1	Explanation by Qualitative Discussion *PPT	CO 5	1.3 4.1	1.3.1 4.1.2
UNIT-5: Non-Destructive Testing of Materials and Electrical Apparatus:						
Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements. High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.	PO1 PO4	PSO 1	Explanation by Qualitative Discussion *PPT	CO4 CO5	1.3 4.1	1.3.1 4.1.2

Text Books:

1. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers Ltd.

2. M. S. Naidu, V. Kamaraju, “High Voltage Engineering”, Tata McGraw Hill Publication Co. Ltd. New Delhi

Reference books:

1. E. Kuffel, W. S. Zaengl, J. Kuffel, “High Voltage Engineering Fundamentals”, Newnes Publication

E-sources:

NPTEL course on “ High Voltage Engineering”

Course Code: 20UEE705E	*Flexible AC Transmission*	*Total credits: 03*
Teaching Scheme		***Evaluation Scheme***
Theory : 3 Hrs/week		***CA: 20 Marks***
Tutorial:--Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks

Course Objectives	1- To provide knowledge about modern trends in Power Transmission Technology 2- To make students understand applications of power electronics in the control of power transmission 3- To educate students for utilization of software like MATLAB for power transmission and control.
Course Outcomes	Student will be able to 1-Explain the basic concepts of FACTS 2-Describe shunt controllers, Various Compensator 3- Explain advantages & control of FACTS applied trans. 4- Describe the basic components of a converter, 5- Describethe methods for compensating reactive power
Pre-requisites	knowledge of Power Electronics and Power systems
Course Type	***Professional Elective subject***

Course Contents						
Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***CO Mapping***	***Competency***	***PI***
UNIT-1 FACTS Concept and General System Considerations:						
Transmission Interconnections, Flow of Power in an AC System, What Limits the Loading Capability? Power Flow and Dynamic Stability Considerations of a Transmission Interconnection	***PO1***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO1**	**1.3**	**1.3.1**
UNIT-2 FACTS Converter:						
Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers, Checklist of Possible Benefits from FACTS Technology, In Perspective: HVDC or FACTS.	***PO1*** ***PO2*** ***PO 4***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	**CO2** **CO3** **CO4**	**1.3** **2.1** **4.1**	**1.3.1** **2.1.3** **4.1.1**
UNIT-3 Static Shunt Compensators:						
Objectives of Shunt Compensation - Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability. Methods of Controllable Var Generation –Thyristor controlled Reactor (TCR) and Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC).Operation of Single Phase TSC – TSR. Switching Converter Type Var Generators, Basic Operating Principles, Basic Control	***PO1*** ***PO2*** ***PO 4***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	CO2 CO3 CO5	**1.3** **2.1** **4.1**	**1.3.1** **2.1.3** **4.1.1**

Approaches. Static VAR Compensators: SVC and STATCOM, the Regulation Slope. Comparison between STATCOM and SVC, V –I and V –Q Characteristics, Transient stability, Response Time.						
UNIT 4: Static Series Compensators:						
Objectives of Series Compensation, Concept of Series Capacitive Compensation, Voltage Stability, Improvement of Transient Stability. GTO Thyristor-Controlled Series Capacitor, Thyristor-Switched Series Capacitor, Thyristor-Controlled Series Capacitor, The Static synchronous Series Compensator, Transmitted Power Versus Transmission AngleCharacteristic.	***PO1*** ***PO2*** ***PO 4***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	CO2 CO3 CO5	**1.3** **2.1** **4.1**	**1.3.1** **2.1.3** **4.1.1**
Unit- 5 Static Voltage and Phase Angle Regulators:						
Thyristor Control Voltage Regulator (TCVR) and Thyristor Control Phase Angle Regulator (TCPAR)Introduction, Objectives of voltage and phase angle Regulation, approaches to Thyristor Controlled Voltage and phase angle Regulators. Switching converter based voltage and phase angle regulators, hybrid phase angle regulators.	***PO1*** ***PO2*** ***PO 4***	***PSO1***	***Explanation by Qualitative Discussion *PPT***	CO3 CO5	**1.3** **2.1** **4.1**	**1.3.1** **2.1.3** **4.1.1**
Unit- 6 Combined Compensators:						
Unified Power Flow Controller (UPFC), Interline Power Flow Controller (IPFC) and Special purpose facts controllers. Concepts of UPFC, IPFC, N.G. Hingorani-sub synchronous resonance (NGH-SSR) damping scheme and Thyristor controlled Braking Resistor and application of FACTS**.**	***PO2*** ***PO 4***	***PSO 1***	***Explanation by Qualitative Discussion *PPT***	CO4 CO5	**1.3** **2.1** **4.1**	**1.3.1** **2.1.3** **4.1.1**

Text Books:

1. N.G. Hingorani and L.Gyugi, “Understanding FACTS” IEEE Press[Indian Edition], New York.
2. J. Arrilaga, Y.H.Liu and N.R.Watson, “Flexible Power Transmission The HVDC Options”, John Wiley and sons Ltd., New York.

Reference books:

1. Yong Hua Song & Allan T Johns, “Flexible ac transmission systems(FACTS), Published by The Institution of Electrical Engineers, London.
2. K.R.Padiyar, “FACTS controllers in transmission and Distribution” New Age Publications, New Delhi.
3. M.H.Rashid , “Power Electronics Handbook”, Academic Press.

E-sources**:** NPTEL course on “FACTS”

Course Code: 20UEE706E	Embedded System	Total credits: 03
Teaching Scheme		Evaluation Scheme
		Mid Sem: 20Marks
Theory: 03 Hrs/week		Simulation Assignment: 20 Marks
Tutorial:		End-Semester: 60

Course Objectives	1. To acquire the knowledge of embedded system. 2. To understand interfacing Technical Aspects of embedded system. 3. To design the embedded system using RTOS & implement real time applications.
Course Outcomes	Students will be able to 1. Acquire the knowledge of embedded system. 2. Understand interfacing Technical Aspects of embedded system. 3. Design the embedded system using RTOS. 4. Implement real time applications based on embedded system. 5. Test the developed system.
Pre-requisites	Microcontroller Application and knowledge of interfacing.
Course Type	Professional Elective course

Course Contents

Unit No	CO Mapping	PO Mapping	PSO Mapping	Competency	PI	*Teaching Methodology	Remark
Unit 1: Introduction to Embedded systems							
Embedded systems, processor embedded into a system, embedded hardware units and devices in a system, embedded software in a system, examples of embedded systems, embedded SOC and use of VLSI circuit design technology, Design process in embedded system, formalization of system design, design process and design examples, classification of embedded systems, skills required for an embedded system designer.	CO1	PO1,2	PSO1, PSO2, PSO3	1.2 1.5 2.1 2.8 3.5	1.2.1 1.6.1 2.5.1 2.5.2 2.8.2	ICT, classroom learning using simulator	
Unit 2: Design Process							
Requirements, Specifications, Architecture Design, Designing of Components, Embedded microcontroller cores, embedded memories. Examples of embedded systems.	CO1	PO1,2	PSO1, PSO2, PSO3	1.2 1.5 2.1 2.8 3.5	1.2.1 1.6.1 2.5.1 2.5.2 2.8.2	ICT, classroom learning using simulator	
Unit 3: Technological aspects of embedded systems							

Interfacing between analog and digital blocks, signal conditioning, digital signal processing, subsystem interfacing,	***CO2***	***PO1,2,3, 5***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.7 5.4***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.7.1 5.4.1***	***ICT, classroom learning using simulator***	
Unit 4: Introduction to RTOS							
Basic Features of an Operating System, Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt-driven System, Multi-rate System Processes and interfacing with external systems, user interfacing. Threads, Context Switching: Cooperative Multi-tasking, Pre-emptive Multi- tasking Basic design using RTOS, Micro/OS-II and Vx works, windows CE, OSEK, real-time Linux functions.	***CO3***	***PO1,2***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2***	***ICT, classroom learning using simulator***	
Unit 5 Case study							
digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card, mobile phone software for key inputs	***CO3***	***PO1,2,3, 4,5***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.7 4.4 5.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.7.1 4.4.1 5.5.1***	***ICT, classroom learning using simulator***	
Unit 6 Implementation							
Challenges in implementation, selection design and implementation of embedded system with real time applications, Presentation and report writing.	***CO3***	***PO1,2,3, 4,5***	***PSO1, PSO2, PSO3***	***1.2 1.5 2.1 2.8 3.7 4.4 5.5***	***1.2.1 1.6.1 2.5.1 2.5.2 2.8.2 3.7.1 4.4.1 5.5.1***	***ICT, classroom learning using simulator***	

Textbooks:

1. Raj Kamal, “Embedded Systems Architecture Programming and Design”, II edition, Tata MC Graw-Hill.

2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness publication.

Reference Books:

1. Steve Heath “Embedded Systems Design”, II edition, Newness publications

2. Tammy Noergaard “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Elsevier publication.

E-sources:

1. ***https://www.nptel.ac.in › courses***
2. ***https://www.coursera.org › courses***

Course Code: 20UEE707E	***Software for Electrical Engineering***	***Total credits: 03***
Teaching Scheme		***Evaluation Scheme***
Theory : 1Hrs/week		***CA: 20 Marks***
Tutorial: 2Hr/week		***Mid Sem: 20 Marks***
		End Sem: 60 Marks

Course Objectives	1. To provide comprehensive idea about different software used in EE field 2. To learn basics, library & tools in software. 3. To learn & apply this software's in solving electrical problems.
Course Outcomes	Students will be able to 1. Understand the basics, library & tools in software 2. Use software & model simple examples. 3. Demonstrate the skills required in software. 4. Apply library & tools functions in solving problems. 5. Analyze solution using software.
Pre-requisites	Engg. Drawing, Electrical circuit, Network analysis, Power system
Course Type	***Elective Core Course***
Course Contents	

Unit No.	***PO Mapping***	***PSO Mapping***	***Teaching Methodology***	***CO Mapping***	***Competency***	***PI***
Unit1: Introduction of MATLAB Basics:						
Variable and Arrays, Sub-arrays, Displaying Data, Data Files, X-Y Plots, Debugging MATLAB Programmes and related applications like Formation of Matrices, valuation of expressions etc. **Basics of Programme Design**: Logic Operators, Branches, Solution of quadratic equation and advance plotting features and related applications like time response of electrical networks etc. **Loops and related applications**: Calculations of RMS value, average value, Geometric mean, Harmonic mean. **SIMULINK** : environment and creating MAT Files. Drawing simulink model to simulate any given function.	***PO1, PO3 PO 5***	***PSO1***	***Explanation by Qualitative Discussion & PPT & Practices***	***CO 1 CO 2 CO 3***	***1.3 3.1 5.1***	***1.3.1 3.1.1 5.1.1***
Unit2: Electrical CAD Electrical schematic drafting:						
Specialized features such as Trim Wire, Scoot and Align Components bus-wiring to a three-phase circuit drawing, three-phase motor with automatic connections and fuses , wire numbers and components and scoot wire numbers and components when editing, Adjust wire crossings	***PO1, PO3 PO 5***	***PSO1***	***Explanation by Qualitative Discussion & PPT & Practices***	***CO 1 CO 2 CO 3 CO 4***	***1.3 3.1 5.1***	***1.3.1 3.1.1 5.1.1***

panel layout drawing: panel components to represent schematic pushbuttons and selector switches, Add nameplates with descriptions for each panel door component, Balloon each of the pushbuttons and the switch with the same balloon number as the parts list						
Unit3: PSCAD						
Creating a small simulation case using PSCAD, Building the power system, Data entry , Results, graphs, plots, and meters ,Interactive control features of PSCAD (sliders, push buttons, dials and switches) Representation of power system components, power electronic and control system elements, Transient Studies	***PO1, PO3 PO 5***	***PSO1***	***Explanation by Qualitative Discussion & PPT & Practices***	***CO 1 CO 2 CO 3 CO 5***	***1.3 3.1 5.1***	***1.3.1 3.1.1 5.1.1***
UNIT4: ETAP (Electrical Transient and Analysis Program)						
design, simulation, operation, and results in power flow studies, AC systems, DC systems etc.	***PO1, PO3 PO 5***	***PSO1***	***Explanation by Qualitative Discussion & PPT & Practices***	***CO 1 CO 2 CO 3***	***1.3 3.1 5.1***	***1.3.1 3.1.1 5.1.1***

Text Books:

1. Getting Started with MATLAB by Rudra Pratap
2. AUTOCAD ELECTRICAL 2016 BLACK BOOK by Gaurav Verma
3. User guide of PSCAD by Manitoba Hydro International Research Centre

Reference Books:

1. Stephen J. *Chapman, "*MATLAB (r) Programming for Engineers" Cengage Learning India 2013
2. Power Systems Analysis Illustrated with MATLAB and ETAP by Hemchandra M. Shertukde

E-sources: Online course on "MATLAB" by Mathworks
Online course on "E Cad" by Autodesk
Online course on "PSCAD" by Manitoba Hydro International & Nayak Corporation
Online course on "ETAP" by ETAP Corporation

Course Code : **20UEE708H**	***Life Skills***	*Total credits: 01*
Teaching Scheme		*Evaluation Scheme*
		CA : - Marks
Theory : 01Hr/week		*Mid sem: -Marks*
Tutorial: -Hr/week		*End-Semester :50 Marks*

Course Objectives	1. To improve the self ability for self growth. 2. To gain knowledge and increase awareness of emotional side of life at work place or place of study. 3. To gain practical experience to know the self potential. 4. To communicate effectively. 5. To develop leadership qualities for self help and others. 6. To manage time and stress effectively. 7. To develop competency to achieve ethical excellence.
Course Outcomes	After completing the course students will be able to 1. Gain self confidence and be competent to face the challenges of life. 2. Practice qualities that will make them emotionally competent. 3. Practice qualities that will make them intellectually competent. 4. Practice qualities that will make them professionally competent. 5. Achieve sense of social competency. 6. Become nice human being.
Pre-requisites	**-**
Course Type	Humanities and Social Sciences

Course Contents

Unit No.	***CO Mapping***	***PO Mapping***	***PSO Mapping***	***Competency***	***PI***	***Teaching Methodology***	***Remark***
Unit 1 : Communication skills							
Listening, Speaking Reading, Writing and different modes of writing Digital Literacy, Effective use of Social Media, Non-verbal communication.	***CO 1, CO 5***	***PO 10***	**-**	***10.1, 10.2, 10.3***	***10.1.1, 10.1.2, 10.1.3. 10.2.1, 10.2.2. 10.3.1, 10.3.2***	Instructor-Led Training, Lectures	
Unit 2 : Professional skills							
Carrier skills: Resume Skills, Interview Skills, Group Discussion Skills, Exploring Career Opportunities. Team skills: Presentation Skills, Trust and Collaboration, Listening	***CO 4***	***PO 9,***	**-**	***9.1, 9.2, 9.3***	***9.1.1, 9.1.2. 9.2.1, 9.2.2, 9.2.3, 9.2.4.***	Project based learning, demonstration, group discussion.	

as a Team Skill, Brainstorming, Social and Cultural Etiquettes, Internal Communication.							
Unit 3 : Leadership and Management skills							
Leadership Skills, Managerial Skills, Entrepreneurial Skills, Innovative Leadership and Design Thinking, Ethics and Integrity.	***CO 4***	***PO 8, PO 9, PO 11, PO 12***	***-***	***8.2 9.1 9.2, 9.3. 11.3 12.1***	***8.2.2 9.1.1 9.2.1, 9.3.1. 11.3.1 12.1.1***	Lectures with role-plays, models; team building games, activity based learning	
Unit 4: Universal Human Values							
Love & Compassion, Truth , Life Skills, Non-Violence, Righteousness Peace, service, Renunciation.	***CO2, CO 5, CO 6***	***-***	***-***			Lectures, Simulated situations Case studies Group discussions.	

Text Books :

1. Sen Madhucchanda (2010), An Introduction to Critical Thinking, Pearson, Delhi.
2. Silvia P. J. (2007), How to Read a Lot, American Psychological Association, Washington DC.
3. Ashokan, M. S. (2015). Karmayogi: A Bbiography of E. Sreedharan. Penguin, UK.
4. Brown, T. (2012). Change by Design. Harper Business.
5. Elkington, J., & Hartigan, P. (2008). The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World. Harvard Business Press.
6. Goleman D. (1995). Emotional Intelligence. Bloomsbury Publishing India Private Limited
7. Joshi Kireet, Education for Character Development, Dharma Hinduja Center of Indic Studies Joshi Rokeach (1973). The Nature of Human Values. New York: The Free Press

E-Resources :

3. Foundation Skills In IT (FSIT) - Refer the websites like https://www.sscnasscom.com/ ssc-projects/capacity-building-and-development/training/fsit/ and
4. Global Business Foundation Skills (GBFS) – Refer websites like https://www.sscnasscom. com/ssc-projects/capacity-building-and-development/training/gbfs/
5. (https://www.sscnasscom.com/ssc-projects/capacity-building-anddevelopment/training/gbfs/) ,and Generic and the entrepreneurial NOS at NSQF Level 4 -7.

Course Code: 20UEE709L	*Electrical Drives LAB*	*Total credits :04*
Execution Scheme		*Evaluation Scheme*
Practical : 02 Hrs/week		*Term work: 25* *VIVA : 50* *Simulation : 25*

Lab outcomes	1. Select a drive for a particular application based on power rating. 2. Select a drive based on mechanical characteristics for a particular drive application. 3. Operate and maintain solid state drives for speed control of DC and AC machines. 4. Operate and maintain solid state drives for speed control of various special electrical machines 5. Students will be able to make various simulation models of various drives.

Course Contents

Sr	**Name Of Practical**	**Type/ Methodology**	**LO**	**PO Mapping**	**PSO Mapping**	**Comp - etency**	**PI**
1	***Speed Control Of Separately Excited Dc Motor By Varying Armature Voltage Using Single-Phase Fully Controlled Bridge Converter.***	***Performance***	***LO1***	***PO2,3***	***PSO1,2,3***	***2.7*** ***3.7***	***2.7.1*** ***3.7.1***
2.	***Speed Control Of Separately Excited Dc Motor By Varying Armature Voltage Using Single Phase Half Controlled Bridge Converter.***	***Performance***	***LO1*** ***LO2***	***PO2,3***	***PSO1,2,3***	***2.7*** ***3.7***	***2.7.1*** ***3.7.1***
3.	***Speed Control Of Separately Excited Dc Motor Using Single Phase Dual Converter***	***Performance***	***LO3***	***PO2,3***	***PSO1,2,3***	***2.7*** ***3.7***	***2.7.1*** ***3.7.1***
4.	***Speed Control Of Separately Excited Dc Motor Using MOSFET/IGBT Chopper***	***Performance***	***LO4***	***PO2,3***	***PSO1,2,3***	***2.7*** ***3.7***	***2.7.1*** ***3.7.1***
5.	***Closed Loop Control Of Separately Excited Dc Motor***	***Performance***	***LO3***	***PO4,5***	***PSO1,2,3***	***4.6*** ***5.6***	***4.6.1*** ***5.6.1***
6.	***Speed Control Of Single Phase Induction Motor Using Single Phase Ac Voltage Controller.***	***Performance***	***LO5***	***PO4,5***	***PSO1,2,3***	***4.6*** ***5.6***	***4.6.1*** ***5.6.1***
7.	***Speed Control Of Three Phase Induction Motor Using Three Phase Ac Voltage Controller***	***Performance***	***LO1*** ***LO3***	***PO4,5***	***PSO1,2,3***	***4.6*** ***5.6***	***4.6.1*** ***5.6.1***
8.	***Speed Control Of Three Phase Induction Motor Using Three Phase Current Source Inverter***	***Performance***	***LO2*** ***LO3***	***PO4,5***	***PSO1,2,3***	***4.6*** ***5.6***	***4.6.1*** ***5.6.1***
9.	***Speed Control Of Three Phase Induction Motor Using Three Phase Voltage Source Inverter***	***Performance***	***LO5*** ***LO2***	***PO4,5***	***PSO1,2,3***	***4.6*** ***5.6***	***4.6.1*** ***5.6.1***
10.	***Speed Control Of Three Phase Slip Ring Induction Motor Using Static Rotor Resistance Control Using Rectifier And Chopper***	***Performance***	***LO3*** ***LO5***	***PO4,5***	***PSO1,2,3***	***4.6*** ***5.6***	***4.6.1*** ***5.6.1***

Course Code: 20UEE710L	*Course Title*	*Total credits: 01*
Execution Scheme	***Switchgear and Protection Lab***	*Evaluation Scheme*
Practical : 02 Hrs/week		*CA: 60* *Exam: 40*

Lab Outcomes	Student will be able to 1. Perform testing and maintenance of switchgear. 2. Gain an ability and skill to design the feasible protection systems needed for each main part of a power system 3. Apply desired protective scheme and observe characteristics of different switchgears

Course Contents

Sr. No	*Name of Practical (any NINE experiments out of following ELEVEN)*	*LO Mapping*	*PO Mapping*	*PSO Mapping*	*Competency*	*PI*	*Type/ Methodology*
1.	*Study of switchgear testing kit*	*LO1*	*PO1, 4*	*PSO 1,2,3*	*1.2* *1.3* *2.1* *3.1* *5.1* *5.2* *10.3*	*1.2.1* *1.3.1* *2.1.1* *2.1.2* *3.1.4* *5.1.1* *5.2.1* *5.2.2* *10.3.1*	***Performance,*** Observation table
2.	*To study characteristics of overload relay*	*LO1*	*PO 1, 4*	*PSO 1,2,3*	*1.2* *1.3* *2.1* *3.1* *5.1* *5.2* *10.3*	*1.2.1* *1.3.1* *2.1.1* *2.1.2* *3.1.4* *5.1.1* *5.2.1* *5.2.2* *10.3.1*	***Performance, Plot*** Characteristics
3.	*To study percentage differential protection of transformer*	*LO2,LO3*	*PO 1,2*	*PSO 1,2,3*	*1.2* *1.3* *2.1* *3.1* *5.1* *5.2* *10.3*	*1.2.1* *1.3.1* *2.1.1* *2.1.2* *3.1.4* *5.1.1* *5.2.1* *5.2.2* *10.3.1*	***Performance***
4.	*To study Merz price protection of alternator*	*LO2,LO3*	*PO 1,2,3*	*PSO 1,2,3*	*1.2* *1.3* *2.1* *3.1* *5.1* *5.2* *10.3*	*1.2.1* *1.3.1* *2.1.1* *2.1.2* *3.1.4* *5.1.1* *5.2.1* *5.2.2* *10.3.1*	***Performance***
5.	*Study and testing of MCB*	*LO1*	*PO 1, 2,3,4*	*PSO 1,2,3*	*1.2* *1.3* *2.1*	*1.2.1* *1.3.1* *2.1.1*	***Performance,*** Observation table

					3.1 5.1 5.2 10.3	***2.1.2 3.1.4 5.1.1 5.2.1 5.2.2 10.3.1***	
6.	***To study performance of overvoltage relay***	***LO3***	***PO 3***	***PSO 1,2,3***	***1.2 1.3 2.1 3.1 5.1 5.2 10.3***	***1.2.1 1.3.1 2.1.1 2.1.2 3.1.4 5.1.1 5.2.1 5.2.2 10.3.1***	***Performance,*** Observation table
7.	***Testing of breakdown strength of transformer oil.***	***LO1,LO2***	***PO 2, 4***	***PSO 1,2,3***	***1.2 1.3 2.1 3.1 5.1 5.2 10.3***	***1.2.1 1.3.1 2.1.1 2.1.2 3.1.4 5.1.1 5.2.1 5.2.2 10.3.1***	***Performance,*** Observation table
8.	***To study flash point test of transformer oil.***	***LO1,LO2***	***PO 2,4***	***PSO 1,2,3***	***1.2 1.3 2.1 3.1 5.1 5.2 10.3***	***1.2.1 1.3.1 2.1.1 2.1.2 3.1.4 5.1.1 5.2.1 5.2.2 10.3.1***	***Performance,*** Observation table
9.	***To realize the various Time-Current characteristics using Over current and earth fault relay***	***LO3***	***PO 1,4***	***PSO 1,2,3***	***1.2 1.3 2.1 3.1 5.1 5.2 10.3***	***1.2.1 1.3.1 2.1.1 2.1.2 3.1.4 5.1.1 5.2.1 5.2.2 10.3.1***	***Performance,*** Plot Characteristics
10.	***To study parallel feeder protection.***	***LO2***	***PO 1,2***	***PSO 1,2,3***	***1.2 1.3 2.1 3.1 5.1 5.2 10.3***	***1.2.1 1.3.1 2.1.1 2.1.2 3.1.4 4.1.1 5.1.1 5.2.1 5.2.2 10.3.1***	Group Learning
11.	***To study distance relays***	***LO1***	***PO 1,2***	***PSO 1,2,3***		***10.3.1***	***Performance***

Course Code: 20UEE711L	DIGITAL SIGNAL PROCESSING LAB	Total credits :01
Execution Scheme		Evaluation Scheme
Practical : 02 Hrs/week		CA- 40 Marks End sem – 40 Marks

Lab outcomes	Students will be able to 1. to compare different signals & system through programs & simulations. 2. to compare different system through programs & simulations. 3. To apply different mathematical techniques on signals & systems. 4. To apply different mathematical operations on signals & systems. 3. To prepare design procedure of various filters.

Course Contents

Sr	Name Of Practical	Type/ Methodology	LO Mappping	PO Mapping	PSO Mapping	Compe-tency	PI
1	1. To generate CT & DT signals.	Performance	LO1	PO1,2	PSO1	1.6	1.6.1
2.	2. To elementary sequences.	Performance	LO1	PO1,2	PSO1,	1.6	1.6.1
3.	3. To perform basic operations on signals.	Performance	LO2	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
4.	4. To perform a Linear Convolution Using MATLAB.	Performance	LO1,2,4	PO1,2	PSO1,2,	1.6 2.7	1.6.1 2.7.1
5.	5. To perform a Circular Convolution Using MATLAB.	Performance	LO1,2,4	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
6.	6. To perform a Sampling and effect of aliasing Using MATLAB.	Performance	LO1,2,3	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
7.	7. To find the DFT/IDFT of a sequence without using the inbuilt functions	Performance	LO1,2,3	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
8.	8. Implementation of FFT of given sequence and obtain the magnitude and phase response of the same.	Performance	LO1,2,3	PO1,2	PSO1,2,	1.6 2.7	1.6.1 2.7.1
9.	9. To implement FIR filters.	Performance	LO1, 5	PO1,2	PSO1,2	1.6 2.7	1.6.1 2.7.1
10.	10. To implement IIR filters.	Performance	LO1, 5	PO1	PSO1,	1.6 2.7	1.6.1 2.7.1

Course Code: 20UEE712L	*High Voltage Engg Lab*			*Total credits: 01*		
Execution Scheme				*Evaluation Scheme*		
Practical : 2 Hr/ week				*CA: 60 marks ESE: 40 marks*		
Lab outcomes	*1- To conduct experiments to study the breakdown characteristics for both uniform and non-uniform material using High AC and DC voltages.* *2-To measure high AC and DC voltages* *3-To measure the breakdown strength of transformer oil.* *4- To verify the characteristics of breakdown voltage vs current*					
Course Contents						
Name Of Practical	*Type/Methodology*	*PO Mapping*	*PSO Mapping*	*LO Mapping*	*Competency*	*PI*
Experiment 1: To perform breakdown test on transformer oil and obtain constants of breakdown voltage	*On testing platform with oil sample*	*PO1*	*PSO1*	*LO 3* *LO 4*	*1.3*	*1.3.1*
Experiment 2: Testing of solid insulation with tape electrodes	*On testing platform with composite material sample*	*PO1*	*PSO1*	*LO 1*	*1.3*	*1.3.1*
Experiment 3: To obtain surface flashover on corrugated porcelain/polymeric insulation system.	*On testing platform with material sample*	*PO1*	*PSO1*	*LO 1*	*1.3*	*1.3.1*
Experiment 4: To understand basic principle of corona and obtain audible and visible corona inception and extinction voltage under non uniform field.	*On simulation platform like virtual lab*	*PO1 PO5*	*PSO1*	*LO 1*	*1.3* *5.1*	*1.3.1* *5.1.1*
Experiment 5: To study experiment on horn gap arrestor and understand arc quenching phenomenon.	*On simulation platform like virtual lab*	*PO1 PO5*	*PSO1*	*LO 1*	*1.3* *5.1*	*1.3.1* *5.1.1*
Experiment 6: To perform various HV insulation tests on cables	*On testing platform with material sample*	*PO1*	*PSO1*	*LO 4*	*1.3*	*1.3.1*
Experiment 7 : To study Generation High D.C. Voltages and measurement	*On simulation platform like virtual lab*	*PO1 PO5*	*PSO1*	*LO 2*	*1.3* *5.1*	*1.3.1* *5.1.1*
Experiment 8: To study Generation High A.C. Voltages and measurement	*On simulation platform like virtual lab*	*PO1 PO5*	*PSO1*	*LO 2*	*1.3* *5.1*	*1.3.1* *5.1.1*
Experiment 9: To study Impulse voltage generation through Marx generator	*On simulation platform like virtual lab*	*PO1 PO5*	*PSO1*	*LO 2*	*1.3* *5.1*	*1.3.1* *5.1.1*
Experiment 10 : To study various types of electrodes for HV testing.	*On simulation platform like virtual lab*	*PO1 PO5*	*PSO1*	*LO 2*	*1.3* *5.1*	*1.3.1* *5.1.1*

Course Code: 20UEE713L	FACTS Lab	Total credits: 01
Execution Scheme		Evaluation Scheme
Practical : 2 Hrs/week		CA: 60 marks ESE: 40 marks

Lab outcomes	1-Student would be able to Simulate, analyse basic semiconductor switches behaviour using software simulator. 2- Student would be able to Simulate, analyse the performance of VAR compensator using software simulator. 3- Student would be able to Analyze the different types of VAR compensation using software simulator.

Course Contents						
Name Of Practical	Type/Methodology	PO Mapping	PSO Mapping	LO Mapping	Competency	PI
Experiment 1: Implement thyristor model	Through software simulation	PO1 PO5	PSO1	LO 1	1.3 5.1	1.3.1 5.1.1
Experiment 2: Implement insulated gate bipolar transistor (IGBT)	Through software simulation	PO1 PO5	PSO1	LO1	1.3 5.1	1.3.1 5.1.1
Experiment 3: Implement phasor model of three-phase static var compensator (Phasor Type)	Through software simulation	PO1 PO2	PSO1	LO 1 LO 2	1.3 2.3	1.3.1 2.3.1
Experiment 4: Implement Thyristor-Based Static Var Compensator	Through software simulation	PO1 PO5	PSO1	LO 2	1.3 5.1	1.3.1 5.1.1
Experiment 5: Implement Static Synchronous Series Compensator (SSSC).	Through software simulation	PO2 PO5	PSO1	LO 2	2.3 5.1	2.3.1 5.1.1
Experiment 6: Frequency-domain and time-domain analysis of a series-compensated transmission system.	Through software simulation	PO2 PO5	PSO1	LO 3	2.3 5.1	2.3.1 5.1.1
Experiment 7 : Static Synchronous Compensator (STATCOM) used for midpoint voltage regulation on a 500-kV transmission line	Through software simulation	PO2 PO5	PSO1	LO 2	2.3 5.1	2.3.1 5.1.1
Experiment 8: Implement GTO-based unified power flow controller	Through software simulation	PO2 PO5	PSO1	LO 2	2.3 5.1	2.3.1 5.1.1
Experiment 9: Implement Thyristor Controlled Series Capacitor (TCSC)	Through software simulation	PO1 PO2	PSO1	LO 2	1.3 2.3	1.3.1 2.3.1
Experiment 10 : Implement Thyristor Controlled Series Capacitor (TCSC)	Through software simulation	PO1 PO2	PSO1	LO 3	1.3 2.3	1.3.1 2.3.1
Experiment 11 : Implement Simulation of the TCR Branch	Through software simulation	PO2 PO5	PSO1	LO 2	2.3 5.1	2.3.1 5.1.1
Experiment 12 : Implement Simulation of the TSC Branch	Through software simulation	PO2 PO5	PSO1	LO 2	2.3 5.1	2.3.1 5.1.1

Course Code: 20UEE714L	Embedded System Lab	Evaluation Scheme
Practical : 02Hrs/week		CA: 60 Marks End sem Exam : 40 Marks
Lab outcomes	Students will be, 1. Introduced with embedded system. 2. Get knowledge of programming and designing. 3. Demonstrate their work on national/international level.	
Course Contents		

Name Of Practical	LO Mapping	PO Mapping	PSO Mapping	Competency	PI	*Type/ Methodology
1. Study of suitable microcontroller for design of embedded system.	LO1	PO1,2,3	PSO1,2	1.6 2.1 3.6	1.6.1 2.5.1 3.6.1	Lab Practical Sessions
2. Basic programming hands on training.	LO2	PO1,2,3	PSO1,2	1.6 2.1 3.6	1.6.1 2.5.1 3.6.1	Lab Practical Sessions
3. Identification of project, design aspects of project and report.	LO2	PO1,2,3	PSO1,2	1.6 2.1 3.6	1.6.1 2.5.1 3.6.1	Problem based learning.
4. Implementation of the system.	LO2	PO1,2,3	PSO1,2	1.6 2.1 3.6 11.5	1.6.1 2.5.1 3.6.1 11.5.1	Problem based learning, Lab Practical Sessions
5. Testing of the embedded system	LO2	PO1,2,3	PSO1,2	1.6 2.1 3.6	1.6.1 2.5.1 3.6.1	Problem based learning, Lab Practical Sessions
6. Error correction and final testing.	LO2	PO1,2,3	PSO1,2	1.6 2.1 3.6	1.6.1 2.5.1 3.6.1	Problem based learning, Lab Practical Sessions
7. Project report and presentation.	LO3	PO1,2,3,10	PSO1,2,3	1.6 2.1 3.6 10.4	1.6.1 2.5.1 3.6.1 10.4.1,2,3	Report writing, Lab Practical Sessions
8. Paper publications in UGC approved journal.	LO3	PO1,2,3,10	PSO1,2,3	1.6 2.1 3.6 10.4	1.6.1 2.5.1 3.6.1 10.4.1,2,3	Paper writing, Lab Practical Sessions
9. Study of aspects of start-up based on project.	LO3	PO1,2,3,10	PSO1,2,3	1.6 2.1 3.6 10.4	1.6.1 2.5.1 3.6.1 10.4.1,2,3	Group Discussion, Lab Practical Sessions
10. National/ International level	LO3	PO1,2,3,10	PSO1,2,3	1.6 2.1 3.6	1.6.1 2.5.1 3.6.1	Participation.

Project competition participation.				***10.4***	***10.4.1,2,3***	
11. Study of copyright /patent filing procedure.	***LO3***	***PO1,2,3,10***	***PSO1,2,3***	***1.6 2.1 3.6 10.4***	***1.6.1 2.5.1 3.6.1 10.4.1,2,3***	***Survey based Learning.***
12. Apply for copyright /patent/Paper Publication in IEEE conference.	***LO3***	***PO1,2,3,10***	***PSO1,2,3***	***1.6 2.1 3.6 10.4***	***1.6.1 2.5.1 3.6.1 10.4.1,2,3***	***Survey based Learning.***

Course Code : 20UEE715L	***Project Part II***	***Total credits: 02***
Teaching Scheme		***Evaluation Scheme***
		CA : 60Marks
Project Hrs : 04 Hrs/week		***Mid sem: -Marks***
		End-Semester : 40 Marks

Course Objectives	1. To inculcate culture of handling all aspects of solution of a practical problem 2. To develop ability to work in group with peers 3. To understand, formulate and analyze the problem resulting into a novel solution.
Course Outcomes	Students will be able 4. to handle all aspects of solution of a practical problem. 5. to work in group with peers 6. to obtain novel solution by understanding, formulating and analyzing the problem.
Pre-requisites	***Project Phase I***
Course Type	***Project***
Course Contents Find solution to the problems in areas of electrical and electronics engineering as proposed by faculty members in earlier phase and present seminars and submission of project report based on the work done.	

SEMESTER VIII

1. Students have to complete any two courses from following Emerging areas of Electrical Engineering (on line courses)

   1. Electrical Power Quality
   2. Electrical and Hybrid Vehicles
   3.Power System Dynamics and Control
   4.Internet of Things
   5.Mechatronics
   6.Robotics

2. Students have to complete six months internship.

MINOR DEGREE:

Student can opt for minor degree by completing 20 credits in any one of the following specializations.

1. Computer Applications.
2. Embedded System and IoT.
3. Mechatronics.
4. Digital Transformation.
5. Business Management.

Minor Degree Offered by Department

Computer Applications (Data Science)	Embedded System & IoT	Mechatronics	Digital Transformation	Business Management
Mathematical foundation for data science: https://onlinecourses.nptel.ac.in/noc20_cs28/preview	Introduction to Embedded System Design https://onlinecourses.nptel.ac.in/noc21_ee58/preview	Mechatronics https://onlinecourses.nptel.ac.in/noc21_me27/preview	1) ARTIFICIAL INTELLIGENCE : https://nptel.ac.in/courses/106/105/106105077/	Engineering Economics Analysis IIT Roorkee https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-me35/
Principles of Data science / Data science for engineers: https://nptel.ac.in/content/syllabus_pdf/106106179.pdf	Introduction to the Internet of Things IIT KGP	Energy Storage and Battery Management Systems https://nptel.ac.in/courses/112/107/112107283/	Digital Architectures & Digital Business Models	Project Management IIT Kanpur https://nptel.ac.in/courses/110/104/110104073/
Python for data science: https://nptel.ac.in/content/syllabus_pdf/106106212.pdf	Introduction to Industry 4.0 and Industrial Internet of Things IIT KGP __ https://nptel.ac.in/courses/106/105/106105195/	Special Purpose Electrical Motors https://nptel.ac.in/courses/108/102/108102156/	3) Digital Marketing: Basics of Digital Marketing : https://onlinecourses.swayam2.ac.in/cec19_mg23/preview	Operation Research IIT Roorkee https://nptel.ac.in/courses/111/107/111107128/
Scalable data science https://nptel.ac.in/content/syllabus_pdf/106105186.pdf	Cloud Computing by IIT KGP https://nptel.ac.in/courses/106/105/106105167/	E-Vehicle Architecture : https://onlinecourses.nptel.ac.in/noc20_ee99/preview	4) Deep Learning & Machine Learning: https://nptel.ac.in/content/syllabus_pdf/106105215.pdf	Financial Management IIT Roorkee https://nptel.ac.in/courses/110/107/110107144/
Hadoop / Big data computing https://nptel.ac.in/content/syllabus_pdf/106104189.pdf	Google Cloud Computing Foundations IIT KGP & Google __ https://nptel.ac.in/courses/106/105/106105223/	Power Converters and Modeling of E-Vehicles https://nptel.ac.in/courses/108/102/108102157/	5) Digital Transformation :	Analytical Skills IIT Kharagpur https://nptel.ac.in/courses/110/105/110105083/
CSE Department	**ECT**	**Mechanical**	**CSE**	

Major Degree Offered by Department

Power System Simulations	Sensors & Robotics	Electrical Vehicle
Electrical Estimation and Costing SY IV Semester	Analog and Digital Communication SY IV Semester	Analog and Digital Communication SY IV Semester
Power Plant Engineering TY V Semester	Sensors & Transducers (Open Elective) TY V Semester	Energy Storage and Battery Management Systems (Open Elective) TY V Semester
Energy Conservation and Auditing TY VI Semester	Embedded System Final Year VII Semester	Special Purpose Electrical MotorFinal Year (Open Elective) VI Semester
Software for Electrical Engineering/FACTS Final Year VII Semester	Mechatronics Final Year VIII Semester MOOCs	Embedded System Final Year VII Semester
Power System Dynamics and Control VIII Semester MOOCs	Robotics Final Year VIII Semester MOOCs	Electrical and Hybrid Vehicles VIII Semester MOOCs
EE	**ECT**	**IRC**