GOVT. COLLEGE OF ENGINEERING
AMRAVATI

DEPARTMENT OF ELECTRICAL ENGINEERING

CURRICULUM

For

B. TECH. (Electrical Engineering)

From 2019 – 20 batch

PROGRAM OBJECTIVES

PEO1: Graduates will possess fundamental knowledge of science, mathematics and electrical engineering and demonstrate expertise in problem solving, analysis and design related to electrical systems.

PEO2: Graduates will be suitable to work in private and public sector, electric utilities, various departments of Central/State/Local Governments, various sectors of Indian industries, multinational corporations and one fifth of them will pursue higher education in chosen field of engineering or management.

PEO3: Graduates will be ethical professionals, sensitive to society and engaged in lifelong learning to remain effective members of their communities/teams and will demonstrate leadership and lifelong learning attitude.

PROGRAM OUTCOMES (POs):

1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.

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

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

B. Tech. (Electrical Engineering)

SEM III

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
HSMC	SHU321C *SHU322C	Transform and Statistical methods **Integral Calculus and Probability**	3	1	---	4	30	10	60	-	-	100	4
ESC	ETU331C	Analog Electronic Circuits	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU321	Transformers and DC Machines	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU322	Electrical Circuit Analysis	3	1	---	4	30	10	60	-	-	100	4
PCC	EEU323	Energy Resources and Generation	3	---	---	3	30	10	60	-	-	100	3
HSMC	SHU322	Constitution of India	1	---	---	0	---	20	30	---	---	50	0
LC	ETU332C	Analog Electronic Lab	---	---	2	2	-	-	-	50	-	50	1
LC	EEU324	Electrical Machines – Lab I	---	---	2	2	-	-	-	50	-	50	1
LC	EEU325	Electrical Circuit Analysis Lab	---	---	2	2	-	-	-	50	-	50	1
	Total		**16**	**2**	**6**	**23**	**150**	**70**	**300**	**150**		**700**	**20**

*** For Direct second year admitted students**

B. Tech. (Electrical Engineering)

SEM IV

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
ESC	ETU431C	Digital Electronics	3	--	---	3	30	10	60	-	-	100	3
PCC	EEU421	AC Machines	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU422	Signals & Systems	3	1	---	4	30	10	60	-	-	100	4
PCC	EEU423	Electromagnetic Fields	4	--	---	4	30	10	60	-	-	100	4
SHMC	SHU425	Human Values and Ethics	1	--	0	1	--	20	30	-	-	50	--
LC	EEU424	Electrical Measurement and Instrumentation Lab	2	---	2	4	-	-	-	50	-	50	3
LC	ETU432C	Digital Electronics Lab	---	---	2	2	-	-	-	50	-	50	1
LC	EEU425	Electrical Machines Lab II	---	---	2	2	-	-	-	50	-	50	1
SHMC	SHU422	Environmental ~~Sciences~~ Studies	1	---	---	1	---	20	30	---	---	50	0
	Total		**17**	**1**	**6**	**24**	**120**	**80**	**300**	**150**	**---**	**650**	**19**

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SEM V

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PCC	EEU521	Power Electronics	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU522	Power Systems – Apparatus and Modelling	3	1	---	3	30	10	60	-	-	100	4
PCC	EEU523	Control System	3	1	---	4	30	10	60	-	-	100	4
PCC	EEU524	Microprocessor and Microcontroilers	3	---	---	3	30	10	60	-	-	100	3
SHMC	EEU525	Industrial Organization & Management	3	---	---	3	30	10	60	-	-	100	3
PEC	EEU526	Program Elective - I	3	---	---	3	30	10	60	-	-	100	3
LC	EEU527	Power Electronics Lab	---	---	2	2	-	-		25	25	50	1
LC	EEU528	Power Systems – Apparatus and Modelling Lab	---	---	2	2	-	-		25	25	50	1
LC	EEU529	Control Systems Lab	---	---	2	2	-	-		50	-	50	1
LC	EEU530	Microprocessor and Microcontrollers Lab	---	---	2	2	-	-		50	-	50	1
	Total		**18**	**2**	**8**	**27**	**180**	**60**	**360**	**150**	**50**	**800**	**24**

20 % contents of each theory course offered shall be declared for self study. Based on these contents students shall deliver seminars. [0 Credits]

Minimum two industrial visits / Industrial Lectures

B. Tech. (Electrical Engineering)

SEM VI													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PCC	EEU621	Power Systems –Operation and Control	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU622	Control System Design	3	1	---	4	30	10	60	-	-	100	4
SHMC	EEU623	Operation Research Techniques	3	1	---	4	30	10	60	-	-	100	4
PEC	EEU624	Program Elective - II	3	---	---	3	30	10	60	-	-	100	3
OEC	EEU625	Open Elective - I	3	---	---	3	30	10	60	-	-	100	3
LC	ETU631	Electronics Design Lab	1	--	4	5	-	-		50	50	100	3
LC	EEU626	Power Systems –Operation and Control Lab	---	---	2	2	-	-		50	-	50	1
LC	EEU627	Control System Design Lab	---	---	2	2	-	-		50	-	50	1
PROJ	EEU628	Minor Project	----	----	2	2	-	-		25	25	50	1
	Total		**16**	**2**	**10**	**28**	**150**	**50**	**300**	**175**	**75**	**750**	**23**

20 % contents of each theory course offered shall be declared for self study. Based on these contents students shall deliver seminars. [0 Credits].

Minimum two industrial visits / Industrial Lectures

B. Tech. (Electrical Engineering)

SEM VII													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PCC	EEU721	Electrical Drives and Control	3	1	---	3	30	10	60	-	-	100	4
PEC	EEU722	Program Elective - III	3	---	---	3	30	10	60	-	-	100	3
PEC	EEU723	Program Elective - IV	3	---	---	3	30	10	60	-	-	100	3
OEC	EEU724	Open Elective - II	3	---	---	3	30	10	60	-	-	100	3
PEC	EEU821	Program Elective - V	3	--	--	3	30	10	60	-	-	100	3
SHMC	EEU823	Energy Management	3	--	--	3	30	10	60	-	-	100	3
LC	EEU725	Electrical Drives and Control Lab	---	---	2	2	-	-		25	25	50	1
	Total		**18**	**1**	**02**	**20**	**180**	**60**	**360**	**175**	**25**	**650**	**20**

B. Tech. (Electrical Engineering)

SEM VIII													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PEC	EEU822	Program Elective - VI	3	--	--	3	30	10	60	-	-	100	3
PROJ	EEU824	A. Project and Seminar **OR** B. Industry Intemship Project	--	--	26	26	-	-	-	200	200	400	13
	Total		**3**	**0**	**26**	**29**	**30**	**10**	**60**	**200**	**100**	**500**	**16**

Program Elective Courses

PE-I	PE-II	PE-III	PE-IV	PE-V	PE-VI
A) Electrical Machine Design	A) Digital Protection	A) EHV AC Transmission	A) Power System Modelling	A) HVDC and FACTS	A) Power System Dynamics and Stability
B) Industrial Electrical Systems	B) Energy Conservation in Electrical Utilities	B) Energy Conservation in Thermal Utilities	B) Smart Grid	B) Power Quality Issues and Mitigation	B)Wind and Solar Systems
C) Digital Signal Processing	C) Advanced Drives	C) AI and Machine Learning	C) Advanced Microprocessors	C) Digital Control System	C)Electrical and Hybrid Vehicles
D) Computer organisation	D) Object Oriented Programming	D) Data Structures	D) Algorithms	D)Computer Network	D) Cyber Security
E) Embeded Systems	E) Internet of Things	E) Energy Storage System	E) Power System Transients	E) Power System Design	Any other course approved by BoS

Open Elective Courses (to be offered by Electrical Engineering department)

Open Elective- I	Open Elective - II
Electromechanical Energy Conversion	**Fundamental of Electrical Drives**
Energy Efficiency in Electrical Utilities	**Electrical Estimating and Costing**

BSC Basic Science Courses
ESC Engineering Science Courses
HSMC Humanities and Social Sciences including Management courses
PCC Professional core courses
PEC Professional Elective courses
OEC Open Elective courses
LC Laboratory course
MC Mandatory courses
SI Summer Industry Internship
PROJ Project

Department of Electrical Engineering

Equivalence Scheme

Programme Name:- Electrical Engineering

Course in old scheme			Course in new scheme		
Course code	Course name	No of credits	Course code	Course name	No of credits
EEU201	Basic Electrical Engineering	02	EEU121	Basic Electrical Engineering	03
EEU202	Basic Electrical Engineering Lab.	01	EEU122	Basic Electrical Engineering Lab.	01

Equivalence-I

S. N.	Course in old Scheme (184)			Equivalent course in new scheme (155)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU303	Engineering Mathematics - III	3	SHU321C	Transform and Statistical methods	4
2	ETU311	Electronic Devices and Circuits	3	ETU331C	Analog Electronic Circuits	3
3	EEU301	Signals & Systems	4	EEU422	Signals & Systems	4
4	EEU302	Network Analysis	4	EEU322	Electrical Circuit Analysis	4
5	EEU303	Electrical Measurement and Instrumentation	3		-----	
6	ETU312	Electronic Devices and Circuits Lab	2	ETU332C	Analog Electronic Lab	1
7	EEU304	Signals & Systems Lab	1		----	
8	EEU305	Network Analysis Lab	1	EEU325	Electrical Circuit Analysis Lab	1
9	EEU306	Electrical Measurement and Instrumentation Lab	1	EEU424	Electrical Measurement and Instrumentation Lab	3
10	SHU305	General Proficiency – II	1		----	
11	SHU401	Engineering Mathematics - IV	3		----	
12	EEU401	Pulse & Digital Circuits	4	ETU431C	Digital Electronics	3
13	EEU402	Electrical Machines – I	3	EEU321	Transformers and DC Machines	3
14	EEU403	Energy Resources & Generation	3	EEU323	Energy Resources & Generation	3
15	EEU404	Electromagnetic Engineering	4	EEU423	Electromagnetic Fields	4
16	SHU402	Engineering Mathematics Lab	2	----		
17	EEU405	Pulse & Digital Circuits Lab	1	ETU 432C	Digital Electronics Lab	1
18	EEU406	Electrical Machines - I Lab	1	EEU324	Electrical Machines Lab I	1
19	EEU407	Numerical Methods Lab	1		-----	
20	EEU408	Computational Lab – I	1		------	

Equivalence-II

S. N.	Course in new scheme (155)			Equivalent course in old Scheme (184)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU321C	Engineering Mathematics - III	4	----	----	----
2	ETU331 C	Analog Electronic Circuits	3	ETU311	Electronic Devices and Circuits	3
3	EEU321	Transformers & DC Machines	3	EEU402	Electrical Machines - I	3
4	EEU322	Electrical Circuit Analysis	4	EEU302	Network Analysis	4
5	EEU323	Energy Resources & Generation	3	EEU 403	Energy Resources & Generation	3
6	ETU322 C	Analog Electronic Lab	1	ETU312	Electronic Devices and Circuits Lab	1
7	EEU324	Electrical Machines Lab I	1	EEU406	Electrical Machines - I Lab	1
8	EEU325	Electrical Circuit Analysis Lab	1	EEU305	Network Analysis Lab	1
9	SHUMC	Environmental Sciences	0		Environmental Sciences	0
10	ETU 431C	Digital Electronics	3	EEU401	Pulse & Digital Circuits	4
11	EEU421	AC Machines	3	EEU502	Electrical Machines - Ii	3
12	EEU422	Signals & Systems	4	EEU301	Signals & Systems	4
13	EEU423	Electromagnetic Fields	4	EEU404	Electromagnetic Engineering	4
14	SHU423 C	Biology – I	2	---		
15	EEU424	Electrical Measurement and Instrumentation Lab	3	EEU306	Electrical Measurement and Instrumentation Lab	1
16	ETU432 C	Digital Electronics Lab	1	EEU405	Pulse & Digital Circuits Lab	1
17	EEU425	Electrical Machines Lab II	1	EEU506	Electrical Machines - II Lab	1
18	SHUMC	NCC/NSS	0		NCC/NSS	0

Equivalence B. Tech. Second Year SH Courses A.Y. 2020-21

S.N.	Course in old scheme			Equivalent course in new Scheme		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU301	Engineering Mathematics- III	03	SHU321A	Differential Equations And Probability	03
2		No Equivalence		SHU322A	Integral Calculus And Probability	03
3	SHU304	Engineering Mathematics- III	03	SHU321B	Transform And Linear Algebra	04
4		No Equivalence		SHU322B	Differential Equation And Transform	04
5	SHU303	Engineering Mathematics- III	03	SHU321C	Transform And Statistical Methods	04
6		No Equivalence		SHU322C	Integral Calculus And Probability	04
7		No Equivalence		SHU323	Introduction To Constitution Of India	00
8		No Equivalence		SHU324	Effective Technical Communication	03
9		No Equivalence		SHU325	Human Values And Ethics	00
10	SHU203	Environmental Studies	03	SHU422	Environmental Studies	00
11		No Equivalence		SHU425	Human Values And Ethics	00
12		No Equivalence		SHU525	Human Values And Ethics	00
13		No Equivalence		SHU725	Human Values And Ethics	00
14	SHU305	General Proficiency- II	2		No Equivalence	
15	SHU401	Engineering Mathematics- IV	3		No Equivalence	
16	SHU402	Engineering Mathematics Lab	2		No Equivalence	
17	SHU403	Engineering Mathematics Lab	2		No Equivalence	

Pulkane

5/ **Head, Mathematics**

P. Tale

Member secretary
BoS Science & Humanities

S.V. Shinde

Chairman
BoS Science & Humanities

Department of Electrical Engineering

Equivalence Scheme for *online courses*

Programme Name:- Electrical Engineering

Dept. of Electrical Engineering, GCoE Amravati				
B Tech & M. Tech NPTEL/MOOCS Equivalent Courses				
Sr. No.,	**Name of Faculty**	**Course Code and Name**	**NPTEL/MOOCS Equivalent Course**	**Remark**
	V sem Third year			
1	Dr. V.N.Ghate	EEU501Electrical Machines – II	Electrical Machines II by IIT Kharagpur	
2	Dr.R.B.Sharma	EEU502Power System Analysis –I	Not Available	
3	Prof. V. M. Harne	EEU503Control System – I	No single course is available which covers 80% of syllabus	
4	Dr. V. B. Virulkar	EEU504Introduction to Microprocessor and Microcontrollers	Not available	
5	Prof. R.M. Sahare.	EEU505Industrial Organisation & Management	Not available	
	VI sem Third year			
1	Prof. A. S. Sindekar	EEU601Power Electronics	P.E.-NPTEL & IITD, Prof. Bhuvaneshwari	Course already starting from 20/07/20, nptel.ac.in
2	Dr.M.V.Jape	EEU602Power System Analysis – II	Power System Aanlysis Prof.Debpriya Das IIT Kharagpur	https://swayam.gov.in/nd1_noc20_ee72/preview
3	Dr.V.N.Ghate	EEU603Control System – II	No single course is available which covers 80% of syllabus	
4	Prof. V. M. Jape	EEU604Electrical Machine Design	Single course with 80% matching is not available	
5	Prof. P. P. Gajbhiye	EEU605Operation Research Techniques to	NIL	No courses found
		VII sem Final year		
1	Dr. K. D.	EEU701Switchgear &	Power System Protection and Switchgear, By Prof.	1) https://swayam.gov.in/nd1_noc20_ee80/preview

	Thakur	Protection	Bhaveshkumar R. Bhalja | IIT Roorkee, **Course starting from 20 July 2020**	2)https://nptel.ac.in/courses/108/107/108107167/
2	Prof. V. M. Harne	EEU702Linear & Digital Integrated Circuits	NIL	No courses found
3	Dr.M.V.Jape	EEU703Computer Methods in PSA	Computer aided power system analysis by Biswaroop Das IIT Kharagpur	https://swayam.gov.in/nd1_noc20_ee88/preview
4	Prof. A. S. Sindekar	EEU704Energy Efficiency in Electrical Utilities	NIL	Not Available
	VIII Sem final Year			
1	Dr. K. D. Thakur	EEU801Power System Stability	Power System Dynamics by Dr. M. L Kothari ,IIT Delhi	https://nptel.ac.in/courses/108/102/108102080/
2	Prof. A. S. Sindekar	EEU802 Electrical Drives and Control	Funda. of ED -Prof.S.P.Das. IIT Kanpur	Dates for 2020=21 not yet declared, swyam.gov.in, nptel.ac.in
3	Dr. V. B. Virulkar	EEU803High Voltage Engineering	Not available	
4	Prof. V. M. Harne	EEU804Power Quality & Deregulation	NIL	No courses found
	MTech (EPS)NPTEL/MOOCS Equivalent Course			
		I- SEM		
1	Dr. M. V.Jape	EEP121Power System Analysis	No single course with 80% matching is available.	
2	Prof. V.M. Jape	EEP122 Power System Modelling	Single course with 80% matching is not available	
3	Dr. G. A. Dhomane	EEP123 High Power Converters	Not Available	
4	Dr. V. B. Virulkar	EEP124 Smart Grid	Introduction to Smart Grid, Prof. N. P. Padhy Prof. Premalata Jena, IIT Rurki	
	II- SEM			
1	Dr. K. D. Thakur	EEP221 Digital Protection	Power System Protection by Prof S.,A Soman IIT Bombay	https://nptel.ac.in/courses/108/101/108101039/

2	Dr. R. B. Sharma	EEP222Power System Dynamics and Stability	Not Available	
3	Dr. G. A. Dhomane	EEP223 HVDC and FACTS	Not Available	
4	Dr. V. B. Virulkar	EEP224Electric and Hybrid Vehicles	Fundamentals of Electric vehicles: Technology & Economics, Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan	
	III- SEM			
1	Dr. N. J. Phadkule	EEP321 AI and Machine Learning	Introduction to Machine Learning- By Prof. Balaraman Ravindran, IIT Madras	https://nptel.ac.in/courses/106/106/106106139/
2	----	EEP322 Open Elective	**TO BE SUBMITTED BY BOS-Science & Humanities**	

EEU 121 Basic Electrical Engineering

Teaching Scheme : 03 L Total: 03 **Credit: 03**
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

To make the students aware and understand:

1. Various fundamental theorems to solve basic electrical engineering problems.
2. Concepts of magnetism and electrical machines.
3. Neccesity of protection and electrical installation.

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's Current and Voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Magnetic Circuits and Transformers (6 hours)

Basics of magnetic circuits, Magnetic materials, BH characteristics, ideal and practical transformer, losses, regulation and efficiency by direct loading, Auto-transformer, three-phase transformer connections (Star and Delta)

Module 4: Electrical Machines (8 hours)

Concept of rotating magnetic fields, Construction, working, starting and speed control of three-phase induction motor, Single-phase induction motor and separately excited dc motor. Construction and working of synchronous generators. [No Numericals on Module 4]

Module 5: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(iii) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011
(iv) E.Hughes,"Electrical and Electronics Technology", Pearson, 2010.
(v) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

EEU 121.1 To understand and analyze basic electric and magnetic circuits
EEU 121.2 To study the working principles of electrical machines and power converters.
EEU 121.3 To introduce the components of low voltage electrical installations

EEU122 Basic Electrical Engineering Lab

Teaching Scheme	**: 02 P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 50 ICA**		**Total Marks: 50**

Course Objectives:

Students will be able to

1. Demonstrate the various laws and theorems of electrical circuits
2. Perform the experiments on electrical machines and able to draw the conclusion from them.
3. Identify various parts of machines and protective devices.

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, Ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor.Generator operation of an induction machine driven at super- synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of Components of LT switchgear.

Laboratory Outcomes

EEU 122.1	Get an exposure to common electrical components and their ratings.
EEU 122.2	Make electrical connections by wires of appropriate ratings.
EEU 122.3	Understand the usage of common electrical measuring instruments.
EEU 122.4	Understand the basic characteristics of transformers and electrical machines.

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

SHU321C TRANSFORM AND STATISTICAL METHODS

Teaching Scheme: 04 L **Total: 04** **Total Credits: 04**

Evaluation Scheme: 30MSE+60ESE+10TA **Total Marks: 100**

Course Objectives:

1. To use method of partial differential equations to solve wave equation, heat equations.
2. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
3. To study probability distributions and their properties.
4. To learn the statistical parameters for different distributions, correlation and regression.
5. To understand the method of curve fitting, testing of hypothesis, goodness of fit.

Partial differential equations: (10 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation and two dimensional Laplace equation.

Laplace Transform:(10 hours)

Bilateral Laplace Transform, Relation between Laplace transform and Fourier transform, Properties of Laplace Transform, properties of unilateral Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response, Causality, Stability, Stability of a causal LTI system

Random variables and Probability Distributions:(10 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Sampling Distributions and Interval of Estimation:(08 hours)

Sampling Distributions: t-distribution, Chi-square distribution, Interval of estimation.

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020, 44th edition.
2. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd,2014.
3. A text book of Engineering Mathematics,N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

1. Advanced Engineering Mathematics,Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V,Ramana,Tata Mc Graw Hill Publishing company Ltd.,New Delhi,2008, 6th edition.
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. An Introduction to Probability and Statistics,V. K. Rohatgi and A.K. Md. Ehsanes Saleh, 2nd Edition.
5. Applied Statistics and Probability for Engineers , D. C. Montgomery and G.C. Runger, 5th edition, John Wiley & Sons, (2009).
6. Introductory Statistics, P. S. Mann, Wiley Publications, 7th edition (2013).
7. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.

Course Outcomes:

After the successfully completion of the course the student will able to

1. solve wave equation, heat equation with the knowledge of Partial differential equations.
2. develop techniques of data interpretation.
3. develop problem solving techniques needed to accurately calculate probabilities and describe the properties of discrete and continuous distribution functions.
4. use statistical tests in testing hypotheses on data.

ELPO/EXTC//INSTRU **(DSY)**

SHU322C INTEGRAL CALCULUS AND PROBABILITY

Teaching Scheme: 03Th+ 01Tut = 04 Total | Total Credits: 04

Evaluation Scheme: 30MSE+60ESE+10TA | Total Marks: 100

Course Objectives:

6. To study method solution of partial differential equations and apply it to solve wave and heat equations.
7. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.
8. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Ordinary differential equations of higher orders:(08hours)

Linear differential equation with constant coefficient, complementary function, particular integral, complete solution; method of variation of parameters.

Integral Calculus :(08 hours)

Beta and Gamma functions and their properties; Evaluation of double integrals (Cartesian & polar),change of order of integration.

Partial differential equations: (08 hours)

Definition, order, degree, classification, formation of partial differential equation, method of separation of variables, first and second order one dimensional wave equation, heat equation

Laplace Transform:(08 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of causal periodic signals, Analysis and Characterization of LTI systems using the Laplace Transform, The transfer function and differential equation, Impulse response and Step response,

Random variables and Probability Distributions:(08 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Text books:

4. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020, 44th edition.
5. Advanced Engineering Mathematics, H.K.Das, S.Chand & Company Pvt.Ltd,2014.
6. A text book of Engineering Mathematics,N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

4. Advanced Engineering Mathematics,Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
5. Higher Engineering Mathematics, B.V,Ramana,Tata Mc Graw Hill Publishing company Ltd.,New Delhi,2008, 6th edition.
6. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
8. An Introduction to Probability and Statistics,V. K. Rohatgi and A.K. Md. Ehsanes Saleh, 2nd Edition.
9. Applied Statistics and Probability for Engineers , D. C. Montgomery and G.C. Runger, 5th edition, John Wiley & Sons, (2009).
10. Introductory Statistics, P. S. Mann, Wiley Publications, 7th edition (2013).
11. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.

Course Outcomes:

After the successfully completion of the course the student will able to

5. To solve partial differential equations and also to solve wave and heat equations.
6. To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
7. Tackle problems related to continuous and discrete probability distributions.

ETU331C Analog Electronic Circuits

Teaching Scheme	**: 03 L Total: 03**	**Credit: 03**
Evaluation Scheme	**: 30 MSE +10 TA+ 60 ESE**	**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**	

Course Objectives:

The subject aims to provide the student with:

1. To study the various electronic circuits using Diode, Transistor and Mosfet
2. To understand the working of various Differential, multi-stage amplifiers
3. Study OpAmp and its application.

Module 1: Diode circuits (4 Hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Module 2: BJT circuits (8 Hours)

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common- collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Module 3: MOSFET circuits (8 Hours)

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

Module 4: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct cqupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 5: Linear applications of op-amp (8 Hours)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift).Analog to Digital Conversion.

Module 6: Nonlinear applications of op-amp (6 Hours)

Hysteretic Comparator,Zero Crossing Detector, Square-wave and triangular-wave generators.Precision rectifier, peak detector.Monoshot.

Text/References:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J.V.Wait, L.P.Huelsman and G.A.Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.

4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog IntegratedCircuits" John Wiley & Sons, 2001.

Course Outcomes:

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

ETU 331C.1 Understand the characteristics of transistors.

ETU 331C.2 Design and analyse various rectifier and amplifier circuits.

ETU 331C.3 Design sinusoidal and non-sinusoidal oscillators..

ETU 331C.4 Understand the functioning of OP-AMP and design OP-AMP based circuits

EEU321 Transformers and DC Machines

Teaching Scheme	**: 03 L Total: 03**	**Credit: 03**
Evaluation Scheme	**: 30 MSE +10 TA+ 60 ESE**	**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**	

Course Objectives:

To make students aware and understand

1. Basic concept of Magnetic Circuit and Electromagnetic force and torque
2. Construction, Operation and testing of of dc machines
3. Operation and testing of transformers (single and three phase)

Magnetic fields and magnetic circuits (6 Hours)

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Module 2: Electromagnetic force and torque (9 Hours)

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. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

Module 3: DC machines (8 Hours)

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Module 4: DC machine - motoring and generation (7 Hours)

Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

Module 5: Transformers (12 Hours)

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of

transformers, Three-winding transformers. Cooling of transformers.

Text / References:

1. A. E. Fitzgerald and C. Kingsley,"Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers,2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Course Outcomes:

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

EEU 321.1	Understand the concepts of magnetic circuits.
EEU 321.2	Understand the operation of dc machines.
EEU 321.3	Analyse the differences in operation of different dc machine configurations.
EEU 321.4	Analyse single phase and three phase transformers circuits.

EEU322 Electrical Circuit Analysis

Teaching Scheme	**: 03 L + 01 T**	**Total: 04**	**Credit: 04**
Evaluation Scheme	**: 30 MSE +10 TA+ 60 ESE**		**Total Marks: 100**
Duration of ESE	**: 2 Hrs.30 min.**		

Course Objectives:

To make students aware and understand to

1. Analyze electrical network problems.
2. Determine transient and steady state behavior of the electrical networks.
3. Estimate the parameters of two port networks.

Module 1: Network Theorems (10 Hours)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

Module 2: Solution of First and Second order networks (8 Hours)

Solution of first and second order differential equations for Series and parallel R-L, R-C, R- L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Module 3: Sinusoidal steady state analysis (8 Hours)

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

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

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

Module 5: Two Port Network and Network Functions (6 Hours)

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

Text / References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury,"Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. Circuit and Network Analysis By Sudhakar Shyammohan Tata Mc Graw Hill 2005

Course Outcomes:

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

EEU 322.1	Apply network theorems for the analysis of electrical circuits.
EEU 322.2	Obtain the transient and steady-state response of electrical circuits.
EEU 322.3	Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).
EEU 322.4	Analyse two port circuit behavior.

EEU323 Energy Resources and Generation

Teaching Scheme : 03 L **Total: 03** **Credit: 03**
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:
To make students aware and understand

1. Challenges of using sources of energy efficiently and effectively
2. The energy conversion systems for various power plants
3. The importance and relevance of renewable energy sources

Module 1: Thermal and Hydro Power plant (08Hours)
Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, coal handling system, ash handling system, Classification of hydro power plant according to available head, nature of load, functions of different components and their working.

Module 2: Nuclear and Diesel Power plant: **(04Hours)**

Methods of producing nuclear reactions, functions of different components of nuclear plant, functions of different components of diesel plant.

Module 3: Solar Energy and its measurement (6 Hours)
Solar constants, solar radiation at earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface, principle of solar energy conversion in to heat, flat plate collectors, energy balance equation and collector efficiency.

Module 4: Fuel cells (6 Hours)
Chemistry applied to fuel cells, principle and operation, classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cells system.

Module 5: Wind Energy (6 Hours)
Basic principle of wind energy conversion, wind data and energy estimation, selection of site, basic components of wind energy conversion system (WECS), classification of WEC systems, generating system, energy storage, and application of wind energy.

Module 6: Ocean and Tidal energy (06 Hours)
Ocean energy resources, ocean energy routes, ocean thermal energy conversion, progressive wave, wave data collection, Basic principle of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of power and energy in simple single basin tidal system.

Module 7: Other Renewable energy resources (06Hours)
Operating principle of energy from biomass. Energy from biogas, geothermal energy. MHD power generation, energy from urban and rural waste, mini and micro hydroelectric power generation.

Expepert lectures from experienced persons shall be arranged on above topics if reaquired.

Text/ References:

1. Conventional Energy Technology, S.B.Pandya, Tata Mc-GrawHill 2005.
2. Non Conventional Energy Resources, G.D.Rai, Khanna Publishers 2001.
3. Energy and Atmosphere, I.M.Campbell, Wiley, New York, 2006.

4. Solar Energy, S.P.Sukhatme, Tata Mc-Graw Hill, 2006.
5. Non Conventional Energy Resourses, B.H.Khan, Tata Mc-Graw Hill, 2003.
6. http://www.nptel.iitm.ac.in/ 5. www.ocw.mit.edu

Course Outcomes:

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

EEU323.1. List and generally explain the main sources of energy and their primary applications nationally and internationally

EEU323.2. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.

EEU323.3. Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment

EEU323.4. Understand the basic physics of wind and solar power generation.

EEU323.5. Understand the issues related to the grid-integration of solar and wind energy systems.

SHU-322 Introduction to Constitution of India

Teaching Scheme: 1 L **Credit: 00**
Evaluation scheme: 60 ESE **Total Marks: 60**

Course Objectives:-

To acquaint students about constitution of India, Fundamental rights, fundamental duties, electoral process and role of central, state and local government and its administration.

Course Content

Unit I:-Introduction to Constitution of India
Salient features of the Constitution of India, Preamble of the Constitution, fundamental rights and fundamental duties, Directive Principles of State Policy and relevance of directive principles. Parliamentary Form of Government in India- President, Vice-President, Prime Minister along with council of Minister, Parliament, Supreme court, Electoral process in India. Amendment Procedure.

Unit II:-State executives Governor, chief minister, state legislature, high courts of state,

Unit III:- Role and functions of local self government- Municipalities in India, with special reference to 73rd amendment. Panchayat Raj in India with special reference to 74th amendment.

Reference Books:-

1. An Introduction to Constitution of India, M.V.Pylee, Vikas Publishing, 2002
2. Constitution of India, Dr. B. R. Ambedkar, Government of India Publication
3. Latest Publications of Indian Institute of Human Rights, New Delhi

Course outcomes:-

On the successful completion of this course, Students shall be able to-

1. Understand and remember the knowledge of basic information about Indian Constitution.
2. Apply the knowledge of fundamental rights and fundamental duties.

ETU332C Analog Electronic Lab

Teaching Scheme	**: 02 P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 50 ICA**		**Total Marks: 50**

Course Objectives:

To make students aware and understand to

1. Design, build, test and analyze performance of various electronic circuits using Diode, Transistor and FET
2. Have experience of design and implementation of various amplifiers
3. Analyze and design various applications of OP-AMP

Minimum eight hands-on experiments related to the course contents of ETU Analog Electronic Circuits **shall be performed. The representative list of experiment is as follows.**

1. To study and compare V-I characteristics of PN- junction diode and Zener diode.
2. To Study of diode as clipper and clamper.
3. To study half wave & full wave rectifier without filter and to calculate its ripple factor
4. To study bridge full wave rectifier without filter and to calculate its ripple factor.
5. To study half wave & full wave rectifier with filter and to calculate its ripple factor
6. To study bridge full wave rectifier with filter and to calculate its ripple factor.
7. To study the input and output characteristics of a given transistor in CE configuration.
8. To Study of CE amplifier- current & power gains and input, output impedances.
9. To study biasing of transistor by following method:

a. Fixed bias. b. Voltage divider bias.

10. To study the frequency response of RC coupled amplifier.
11. Measurement and study of output characteristics of JFET.
12. Measurement and study of output characteristics of MOSFET.
13. To study Hartley oscillator.
14. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.

15To study biasing of transistor by following method:

a. Fixed bias. b. Voltage divider bias.

Course Outcomes:

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

ETU 332C.1 Set up a bias point in a transistor.

ETU 332C.2 Verify the working of diodes, transistors and their applications.

ETU 332C.3 Build a common emitter/base/collector amplifier and measure its voltage gain.

ETU 332C.4 Explore the operation and advantages of feedback amplifiers.

ETU 332C.5 Learn to design different types of filters and apply the same to oscillators and amplifiers.

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

EEU324 Electrical Machines – Lab I

Teaching Scheme	**: 02 P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 50 ICA**		**Total Marks: 50**

Course Objectives:

To make the students aware and understand:

1. Various parts of d.c. machine and transformer
2. Operation and performance of dc motors
3. Testing of dc machines and transformers

Minimum Eight hands-on experiments related to the course contents of EEU321 Electrical Machines –I to be performed. Representative list is as follows,

1. To identify and understand the functions of various parts of d.c. machines
2. To plot the OCC of d.c. generator
3. To find the critical speed of the d.c. generator
4. To perform and verify the speed control method of d.c. shunt motor
5. To perform the Swinburn test on d.c. machine
6. To perform the load test on d.c. series generator
7. To perform the load test on d.c. series motor
8. To perform the load test on d.c. shunt generator
9. To perform the load test on d.c. shunt motor
10. To perform the load test on d.c. compound generator
11. To perform the load test on d.c. compound motor
12. To perform the test/tests on d.c. machine to separate the losses at constant speed
13. To perform the Hopkinson's Test on d.c. machines
14. To perform the Field test on the d.c. machines
15. To perform the Sumpner's Test on single phase transformer
16. To identify and understand the functions of various parts of the three phase transformer
17. To perform the OC and SC test on three phase transformer
18. To perform the direct loading test on three phase transformer
19. To perform the various connections of three phase transformer
20. To study the scott connection of transformer
21. To perform OC and SC test on single phase transformer

Course Outcomes :

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

EEU 324.1	Identify and understand the functions of various parts of d.c. machines
EEU 324.2	Plot various characteristics of dc generators
EEU 324.3	Start and operate dc motor according to requirement
EEU 324.4	Test dc machines and transformers

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

EEU325 Electrical Circuit Analysis Lab

Teaching Scheme : 02 P Total 02 **Credit: 01**
Evaluation Scheme : 50 ICA **Total Marks: 50**

Course Objectives:

To make the students aware and understand:

1. Various electrical circuit theorems.
2. Two port network parameters.
3. Steady state response of electrical circuits.

Minimum Eight Hands-on experiments related to the course contents of EEU322 Electrical Circuit Analysis to be performed.. Representative list is as follows.

1. To find self inductance of two coils, mutual inductance between the coils and coefficient of coupling.
2. To verify Maximum Power Transfer theorem.
3. To verify Compensation theorem.
4. To verify Tellegen's theorem.
5. To find Z parameters of two, two port networks connected in series.
6. To find Y parameters of two, two port networks connected in parallel.
7. To determine ABCD parameters of given two port network
8. To find transmission parameters of two, two port networks connected in cascade.
9. To study the response of RL series circuit to sinusoidal input and dc input (using MATLAB).
10. To study the response of RC series circuit to sinusoidal input and dc input (using MATLAB).

Course Outcomes :

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

EEU 325.1 Contruct simple electrical circuits using suitable elements
EEU 325.2 Perform experimnts for verification of various facts and principles
EEU 325.3 Derive conclusions on the basis of the readings/ observations

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ETU431C Digital Electronics

Teaching Scheme : 03 L Total: 03 **Credit: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

1. To acquire the basic knowledge of digital logic circuit components
2. To understand and analyze and design combinational logic circuits using gates and MSIs
3. To design and realize combinational and sequential digital electronic circuits

Module 1:Fundamentals of Digital Systems and logicfamilies (7Hours)

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples oflCgates, number systems-binary, signed binary, octal hexadecimal number, binaryarithmetic,one's and two's complements arithmetic, codes, error detecting and correctingcodes,characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

Module 2: Combinational DigitalCircuits (7Hours)

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer,De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder,serialadder, ALU, elementary ALU design, popular MSI chips, digital comparator,paritychecker/generator, code converters, priority encoders, decoders/drivers for display devices,Q-M method of functionrealization.

Module 3: Sequential circuits and systems (7Hours)

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-TandD-types flipflops, applicationsof flipflops, shiftregisters, applications of shift registers, serialtoparal lel converter, parallel to serial converter, ring counter, sequence generator,ripple(Asynchronous) counters, synchronous counters, counters design using flip flops,specialcounter IC's, asynchronous sequential counters, applications ofcounters.

Module 4: A/D and D/A Converters (7Hours)

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit,analog to digital converters: quantization and encoding, parallel comparator A/Dconverter,successive approximation A/D converter, countingA/D converter, dual slope A/Dconverter, A/Dconverter using voltage to frequency and voltage to time conversion, specificationsofA/Dconverters, example of A/D converterICs

Module 5: Semiconductor memories and Programmable logic devices. (7Hours)

Memory organization and operation, expanding memory size,classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

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

CourseOutcomes:

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

ETU 431C.1	Understand working of logic families and logic gates.
ETU 431C.2	Design and implement Combinational and Sequential logiccircuits.
ETU 431C.3	Understand the process of Analog to Digital conversion and Digital to Analog conversion.
ETU 431C.4	Be able to use PLDs to implement the given logical problem.

EEU421 AC Machines

Teaching Scheme : 03 L Total: 03 **Credit: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

To make students aware and understand

1. Basic concept of AC machine winding and revolving magnetic field
2. Operation and testing of Induction machine (single and three phase)
3. Construction , Operation and testing of synchronous machines

Module 1: Fundamentals of AC machine windings (8 Hours)

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single- turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor

Module 2: Pulsating and revolving magnetic fields (4 Hours)

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Module 3: Induction Machines (12 Hours)

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect ofparameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

Module 4: Single-phase induction motors (6 Hours)

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications

Module 5: Synchronous machines (10 Hours)

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Text/References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
6. P. C. Sen "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Course Outcomes:

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

EEU 421.1	Understand the concepts of rotating magnetic fields.
EEU 421.2	Understand the operation of ac machines.
EEU 421.3	Analyse performance characteristics of ac machines.

EEU422 Signals and Systems

Teaching Scheme : 03 L + 01 T **Total: 04** **Credit: 04**
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

1. Understand the concepts of continuous time and discrete time systems.
2. Able to find output of LTI system by convolution.
3. Analyse LTI systems in frequency domain

Module 1: Introduction to Signals and Systems (3 hours):

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

Module 2: Behavior of continuous and discrete-time LTI systems (8 hours)

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

Module 3: Fourier, Laplace and z- Transforms (10 hours)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Module 4: Sampling and Reconstruction (4 hours)

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

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.

2. J. G. Proakis and D. G. Manolakis, " Digital Signal Processing: Principles, Algorithms and Applications", Pearson, 2006.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
6. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

Course Outcomes:

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

EEU 422.1	Understand the concepts of continuous time and discrete time systems.
EEU 422.2	Analyse systems in complex frequency domain.
EEU 422.3	Understand sampling theorem and its implications.

EEU423 Electromagnetic Fields

Teaching Scheme : 04 L Total: 04 **Credit: 04**
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2 Hrs.30 min.

Course Objectives:

To make the students aware and understand:

1. Electrostatic boundary-value problems.
2. The types and properties of magnetic materials.
3. The concept of static and time varying fields.

Note:-This course shall have Lectures and Tutorials. Most of the students find difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.

Module 1: Review of Vector Calculus (6 hours)

Vectoralgebra-addition,subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vectorcalculus-differentiation, partial differentiation,integration,vector operator del, gradient, divergence and curl;integraltheoremsofvectors. Conversion of a vector from one coordinatesystem toanother.

Module 2: Static Electric Field (6 Hours)

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density

Module 3: Conductors, Dielectrics and Capacitance (6 Hours)

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

Module 4: Static Magnetic Fields (6 Hours)

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Module 5: Magnetic Forces, Materials and Inductance (6 Hours)

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

Module 6: Time Varying Fields and Maxwell's Equations (6 Hours)

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.

Text / References:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics",Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Course outcomes:

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

EEU 423.1	To understand the basic laws of electromagnetism.
EEU 423.2	To obtain the electric and magnetic fields for simple configurations under static conditions.
EEU 423.3	To analyse time varying electric and magnetic fields.
EEU 423.4	To understand Maxwell's equation in different forms and different media.
EEU 423.5	To understand the propagation of EM waves.

SHU-~~424~~ 422 ENVIRONMENTAL STUDIES

Teaching Scheme: 02 L	**Total: 02**	**Credit: 00**
Evaluation scheme: 60 ESE	**ESE Duration: 2:30 hrs**	**Total Marks: 60**

Course objectives:-

The objectives of offering this course are to-

- Be aware of various environmental factors and there preservation.
- Teach them how to protect Environment and natural resources.
- How to make equitable use of energy resources.

The Multidisciplinary Nature of Environmental Studies:- Definition, scope and importance, Need for public awareness.

Social issues and Environment:- From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rainwater harvesting, and watershed management Resettlement and rehabilitation of people, problems.

Environmental ethics:- Issues and possible solution, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation. Consumerism and Waste products, Environment protection act, Air (prevention & control) act, Water (prevention and control) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation.

Human population and environment:- Environment and human health, Human rights, Role of Information Technology in Environment and human health, Public awareness.

Natural Recourses:- Conventional energy resources: definition, classification, composition, energy content types: coal, petroleum, natural gases, hydrogeothermal, nuclear, environmental implication of energy uses. Non conventional energy resources: solar energy, wind energy, tidal energy, geothermal energy, hydropowers and biogas.

Ecosystem and Biodiversity:-Concept of ecosystem, Structure and function of ecosystem, Producer, consumer, decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystem: Forest ecosystem, Grass land ecosystem, Desert ecosystem Aquatic ecosystem (Rivers and ocean).

Introduction- definition: genetics, species and ecosystem, diversity.

Biogeographically classification of India. Conservation of biodiversity- In-situ and Ex-situ conservation of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Value of biodiversity: consumptive use,

productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as mega diversity nation. Hot spot of biodiversity.

Environmental Pollution:- Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste, Management, Causes effects and control measures, Role of individual in prevention of pollution, Hazardous waste management, Biomedical waste management, Disaster management: floods, earthquake, cyclone and landslides.

Course outcomes:-

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

- Convey the Environmental awareness among peoples.
- Apply Conservation of various natural resources and environmental factors.
- Aware about social and environmental issues.

Recommended Books:

1) The Biodiversity of India, Bharucha Erach ,Marin Publishing Pvt. Ltd., Ahmedabad
2) Brunner R.C., 1989,Hazardous Waste Incineration, McGraw Hill Inc.
3) Marine pollution, Clark R.S., Clanderson Press Oxford (TB)
4) Environmental Chemistry, De A.K. Wiley Estern Lmt.
5) Environmental Chemistry, Sharma B.K., 2001 Goel Publ., House, Meerat.
6) Environmental Management, Wagner K.D., 1998, W.B. Saunders Co., Philadel phia, USA
7) Environmental Studies, Benny Joseph, 1st edition,2005,Tata Mcgraw-Hill Publ.

EEU424 Electrical Measurement and Instrumentation Lab

Teaching Scheme : 02 L + 02 P Total 04 **Credit: 03**
Evaluation Scheme : 50 ICA **Total Marks: 50**

Course Objectives:
To make the students aware and understand:

1. Different bridges and their applications.
2. Different transducers and their working principles.
3. Measurement of non-electrical parameters like pressure, force, velocity etc.

Lectures/Demonstrations:

1. Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.
2. Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, C_p, C_{pk}.
3. Sensors and Transducers for physical parameters: temperature, pressure, torque, flow.Speed and Position Sensors.
4. Current and Voltage Measurements. Shunts, Potential Dividers,.Instrument Transformers, Hall Sensors.
5. Measurements of R, L and C.
6. Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.
7. Digital Storage Oscilloscope.

Experiments

1. Measurement of a batch of resistors and estimating statistical parameters.
2. Measurement of L using a bridge technique as well as LCR meter.
3. Measurement of C using a bridge technique as well as LCR meter.
4. Measurement of Low Resistance using Kelvin's double bridge.
5. Measurement of High resistance and Insulation resistance using Megger.
6. Usage of DSO for steady state periodic waveforms produced by a function generator. Selection of trigger source and trigger level, selection of time-scale and voltage scale.Bandwidth of measurement and sampling rate.
7. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.
8. Usage of DSO to capture transients like a step change in R-L-C circuit.
9. Current Measurement using Shunt, CT, and Hall Sensor.

Course Outcomes:

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

EEU 424.1 Design and validate DC and AC bridges.

EEU 424.2 Analyze the dynamic response and the calibration of few instruments.

EEU 424.3 Learn about various measurement devices, their characteristics, their operation and

their limitations.

EEU 424.4 Understand statistical data analysis.

EEU 424.5 Understand computerized data acquisition.

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

SHU 425 HUMAN VALUES AND ETHICS

Teaching Scheme: 1 Th **Credit: 00**
Evaluation scheme: 20TA+30ESE **Total Marks: 50**
ESE Duration: 1Hr 30 Min.

Objectives:

1. To develop the importance of moral virtue through spiritual and yoga activities which leads to professional experience of students.
2. To understand the dimension of professional ethics.
3. To learn engineering ethics through theories which develop moral judgment among technical students.
4. To understand the global ethical issues and its dimension which leads to moral leadership.

Human Values

Morals, values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Harmony-Human Harmony, Nature Harmony, Harmony in Society, Honesty, Courage, Valuing time, Self-confidence, Character, Spirituality, Introduction to yoga and meditation for professional excellence and stress management.

Professional Ethics

Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Professional Ethics; Principles of Professional Ethics Conflict of Interest, Gift Vs Bribery, Attendance Vs Punctuality,

Engineering Ethics

Senses of 'Engineering Ethics', Variety of moral issues, Types of inquiry, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Models of professional roles.

Global Issues

Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Moral Leadership, Code of Conduct, Corporate Social Responsibility

Text books:

1. Ethics in Engineering, Mike W. Martin and Roland Schinzinger, Tata McGraw Hill, New Delhi, 2003.
2. Engineering Ethics, Govindarajan M, Natarajan S, Senthil Kumar V. S, Prentice Hall of India, New Delhi, 2004.

Reference books:

1. Engineering Ethics, Charles B. Fleddermann, Pearson Prentice Hall, New Jersey, 2004.
2. Engineering Ethics – Concepts and Cases, Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, Cengage Learning, 2009

3. Ethics and the Conduct of Business, John R Boatright, Pearson Education, New Delhi,2003
4. Fundametals of Ethics for Scientists and Engineers, Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford, 2001
5. Business Ethics: Decision Making for Personal Integrity and Social Responsibility, Laura P. Hartman and Joe Desjardins, McGraw Hill education, India Pvt.Ltd.,New Delhi 2013.
6. Value Education, World Community Service Centre, Vethathiri publications, Erode, 2011

Outcomes:

After the successful completion of the course the student shall be able to

1. Make work life balance and found himself or herself with sound mindset at workplace.
2. Incorporate professional ethics at work place.
3. Manage moral dilemmas and conflicts at workplace.
4. Develop global perspective for ethical issues.

ETU432C Digital Electronics Lab

Teaching Scheme	**: 02 P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 50 ICA**		**Total Marks: 50**

Course Objectives:

1. To acquire the hands-on experience of digital component, circuit realization using bread board
2. To realize combinational logic circuits using Logic gates and MSIs
3. To realize sequential circuits using gates, FF and MSIs

Minimum Eight hands-on experiments related to the course contents of ETU Digital Electronics to be performed. Representative list is as follows,

1. To verify truth table of different logic gates.
2. NOR gate as universal gate: Realization of AND/ OR/ NAND/ NOT/ EX-OR gates using NOR gates only
3. NAND gate as universal gate: Realization of AND/ OR/ NOR / NOT/ EX-OR gates using NAND gates only
4. Realization of half adder using gates
5. Realization of half subtractor using gates
6. Implementation of full Adder circuit using gates
7. To study Flip-Flops (Realization of RS/ T/ D/ JKMS flip-flops using logic gates)
8. To study counters: Up counter/ down counter/ up-down counter/ decade counter
9. To study shift registers: Left shift/ right shift register
10. To study analog to digital converter
11. To study digital to analog converter

Course Outcomes :

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

ETU 432C.1	Analyze and design simple logic circuits using gates
ETU 432C.2	Construct the circuits for experiments and take readings/ observations
ETU 432C.3	Derive conclusions on the basis of the readings/ observations in context of digital electronics
ETU 432C.4	Explain the working principle of various combinational and sequential logic circuits
ETU 432C.5	Explain the working principle of ADC and DAC

Note:

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

EEU425 Electrical Machines Lab II

Teaching Scheme	**: 02 P**	**Total: 02**	**Credit: 01**
Evaluation Scheme	**: 50 ICA**		**Total Marks: 50**

Course Objectives:

Minimum Eight Hands-on experiments related to the course contents of EEU 421 Electrical Machines - II to be performed. Representative list is as follows

1) To Determine the regulation of three phase Alternator by direct loading method
2) To determine the regulation of three phase Alternator by Synchronous Impedance Method
3) To find Xd and Xq of salient pole synchronous machine by slip test
4) To study starting and reversal of direction of rotation of three phase synchronous motor
5) To plot the 'V' and 'Inverted V' curves of synchronous motor
6) Application of synchronous motor as power factor correction device
7) To perform the load test on three phase induction motor and plot its characteristics
8) Perform the No load and short circuit test on three phase Induction motor to find its Equivalent circuit
9) Construction of Circle diagram from the No load and short circuit test Data
10) Speed control of three phase induction motor
11) Study of three phase induction motor starters
12) Running light and locked rotor test on single phase induction motor to find its equivalent circuit.
13) Parallel operation of Alternators (Synchronizing Methods)

Course Outcomes

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

1) Identify and understand the functions of various parts of alternators
2) Plot various characteristics of alternators
3) Start and operate induction motor according to requirement
4) Test induction motors

Note:-

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.