

**GOVT. COLLEGE OF ENGINEERING,
AMRAVATI**

DEPARTMENT OF ELECTRICAL ENGINEERING



CURRICULUM

For

Final Year B. TECH. (Electrical Engineering)

2022- 2023

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. Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Semester I

Teaching Scheme							Evaluation Scheme						
Category	Course Code	Course Title	Theory	Tutorial	Practical		Theory			Practical		Total	Credits
			Hrs/week	Hrs/week	Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
MC	SHU100	Induction Program	Two weeks mandatory audit course										0
BSC	SHU121	Physics	3	1	--	4	30	10	60	--	--	100	4
BSC	SHU122	Calculus and Linear Algebra	3	1	--	4	30	10	60	--	--	100	4
ESC	EEU121	Basic Electrical Engineering	3	--	--	3	30	10	60	--	--	100	3
ESC	CEU121	Engineering Mechanics	3	--	-	3	30	10	60	--	--	100	3
HSMC	SHU123	English	2	--	--	2	--	--	60	--	--	60	2
BSC/LC	SHU124	Physics Lab	--	--	2	2	--	--	--	50	--	50	1
ESC/LC	EEU122	Basic Electrical Engg Lab	--	--	2	2	--	--	--	50	--	50	1
ESC/LC	CEU122	Engineering Mechanics Lab	--	--	2	2	--	--	--	50	---	50	1
HSMC/LC	SHU125	English Lab	--	--	2	2	--	--	--	50	--	50	1
ESC/LC	MEU121	Workshop Practice I	--	--	2	2	--	--	--	50	--	50	1
		Total	14	2	10	26	120	40	300	250	0	710	21

Semester II

Teaching Scheme							Evaluation Scheme						
Category	Course Code	Course Title	Theory	Tutorial	Practical		Theory			Practical		Total	Credits
			Hrs/week	Hrs/week	Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
BSC	SHU221	Chemistry	4	--	--	4	30	10	60	--	--	100	4
BSC	SHU222	Integral calculus and differential equations	3	1	--	4	30	10	60	--	--	100	4
ESC	CSU221	Programming for Problem solving	3	--	--	3	30	10	60	--	--	100	3
ESC	MEU221	Engineering Graphics	2	--	--	2	30	10	60	--	--	100	2
ESC	MEU222/ ETU221	Basic Mechanical Engineering/ Basic Electronics Engineering	2	--	--	2	30	10	60	---	--	100	2
BSC/LC	SHU223	Chemistry Lab	--	--	2	2	--	--	--	50	--	50	1
ESC/LC	CSU222	Programming for Problem solving Lab	--	--	4	4	--	--	--	50	--	50	2
ESC/LC	MEU223	Engineering Graphics Lab	--	--	4	4	--	--	--	50	--	50	2
ESC/LC	MEU224	Workshop Practice II	--	--	2	2	--	--	--	50	--	50	1
		Total	14	1	12	27	150	50	300	200	--	700	21

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
MSE Duration: 1.30 Hrs all courses

Important Note:

MEU222 for only Electrical, Electronics & TC, Computer Science, Information Technology and Instrumentation Engineering branch

ETU221 for only Civil and Mechanical Engineering branch

In Semester I, the students of Civil, Mechanical, Electrical & Instrumentation Engineering shall be offered group A courses, and that of

Electronics & TC, Computer Science and Information Technology shall be offered group B courses. In Semester II, vice versa.

In addition following courses are offered

SHU122 and MEU121 for all students in Semester I. SHU222 and MEU224 for all students in Semester II.

MEU222 shall be offered in Semester I for Electronics & TC, Computer Science, Information Technology branch. And it shall be offered in

Semester II for Electrical and Instrumentation Engineering branch

ETU221 shall be offered in Semester II for Civil and Mechanical Engineering branch.

There should be direct correspondence of group A and group B courses.

Sr. No.	Group A Courses		Group B Courses	
	Course Code	Title of Course	Course Code	Title of Course
1	SHU121	Physics	SHU221	Chemistry
2	EEU121	Basic Electrical Engineering	CSU221	Programming for Problem solving
3	CEU121	Engineering Mechanics	MEU221	Engineering Graphics
4	SHU123	English	SHU223	Chemistry Lab
5	SHU124	Physics Lab	CSU222	Programming for Problem solving Lab
6	EEU122	Basic Electrical Engineering Lab	MEU223	Engineering Graphics Lab
7	CEU122	Engineering Mechanics Lab		
8	SHU125	English Lab		
Category of Course		Definition	Credits	
BSC		Basic Science Courses	18	
ESC		Engineering Science Courses	21	
HSMC		Humanities and Social Sciences including Mgt.Courses	3	
			Total Credits	42

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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	SHU323	Introduction to Constitution of India	1	--	--	0	--	20	30	--	--	50	0
LC	ETU332C	Analog Electronic Circuits 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

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SEM IV													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		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	0	--	4	30	10	60	-	-	100	4
SHMC	SHU425	Human Values and Ethics	1	0	0	1	0	20	30	-	-	50	0
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	1	--	--	1	0-	20	30	--	---	50	0
	Total		17	1	6	24	120	80	300	150	0-	650	19

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SEM V													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs. /week	Tutorial Hrs./week	Practical Hrs./week	Total	Theory			Practical		Total	
							MSE	TA	ESE	ICA	ES E		
PCC	EEU521	Power Electronics	3	0-	0-	3	30	10	60	-	-	100	3
PCC	EEU522	Power Systems – Apparatus and Modelling	3	1	--	4	30	10	60	-	-	100	4
PCC	EEU523	Control System	3	--	--	3	30	10	60	-	-	100	3
PCC	EEU524	Microprocessor and Microcontrollers	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	1	8	27	180	60	360	150	50	800	23

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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	EEU633	Open Elective – I	3	--	--	3	30	10	60	-	-	100	3
LC	ETU631	Electronics Design Lab	1	0	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	00	00	2	2	-	-	-	25	25	50	1
	Total		16	2	10	28	150	50	300	175	75	750	23

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SEM VII													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		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	EEU733	Open Elective - II	3	--	--	3	30	10	60	-	-	100	3
PEC	EEU725	Program Elective - V	3	--	--	3	30	10	60	-	-	100	3
SHMC	EEU726	Energy Management	3	--	--	3	30	10	60	-	-	100	3
LC	EEU727	Electrical Drives and Control Lab	---	--	--	2	-	-	-	25	25	50	1
	Total		18	1	02	20	180	60	360	175	25	650	20

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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	EEU821	Program Elective - VI	3	0	0	3	30	10	60	-	-	100	3
PROJ	EEU822	A. Project and Seminar OR B. Industry Internship Project	0	0	26	26	-	-	-	200	200	400	14
	Total		3	0	26	29	30	10	60	200	100	500	17

Program Elective Courses

PE-I	PE-II	PE-III	PE-IV	PE-V	PE-VI
A) Electrical Machine Design	A) Power system 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) High Voltage Engineering	B) Smart Grid	B) Power Quality Issues and Mitigation	B) Wind and Solar Systems
C) Digital Signal Processing	----	C) AI and Machine Learning	C) Advanced Microprocessors	C) Digital Control System	C) Electrical and Hybrid Vehicles
D) Computer organization	D) Object Oriented Programming	D) Data Structures	D) Algorithms	D) Computer Network	D) Cyber Security
E) Embedded Systems	E) Internet of Things	E) Energy Storage System	E) Power System Transients	E) Power System Planning and Design	E) Advanced Drives

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

EEU721 ELECTRICAL DRIVES AND CONTROL

Teaching Scheme: 03 L + 00 T

Total: 03 Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Course Objectives:

- I. To expose students to the operation, application and control of power conversion systems employing electric drive to cater to industrial needs.
- II. To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications.
- III. To provide strong foundation to assess performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.

Introduction to Electrical Drives: Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

Starting and Braking of Electrical Drives: Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, braking of dc and induction motors.

DC Drives: Single phase half, full and dual converter based dc drives-Circuit configurations, input output waveforms, Calculation of torque, speed, power factor, firing angle etc. Torque-Speed characteristics. DC Chopper based dc drives- Circuit configurations, input-output waveforms, Calculation of torque, speed, duty cycle etc. Torque-speed characteristics.

Induction Motor Drives: Scalar control of induction motor-stator voltage and stator frequency control using stator voltage controllers and inverters-circuit configurations, calculation of current, torque, speed etc. Torque-Speed characteristics. Slip power recovery schemes-rotor chopper/ inverter control of induction motor-Circuit configurations and theoretical concepts only.

Industrial Applications: Electrical drives system for Rolling mills, paper mills, cement mills, sugar mills, textile mills, and traction and machine tool applications.

Text Books:

1. Fundamentals of Electrical Drives, G. K. Dubey, Narosa Publishing House, 2005
2. Electric Drives-Concepts and Applications, V.Subrahmanyam TMH Pub, 2004
3. Modern Power Electronics and AC Drives by B.K.Bose Pearson Education, Asia, 2003
4. Electric Drives, De and Sen PHI Pub, 1999

References Books:

1. Thyristor DC Drives P.C. Sen John Wiley & Sons, 1981.
2. Power Electronic Control of AC Motors", JMD Murphy & FG Turnbull, Pergamon Press, 1988.

3. Power Semiconductor Controlled Drives”, G.K.DubeyPH Int., 1989.
4. Power Semiconductor Drives” Deewan, Straughan & Slemon John Wiley & Sons.
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

Course Outcomes:

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

- EEU721.1. Identify various electrical controllers/motors and their functions/ characteristics.
- EEU721.2. Select proper motor and controller for given application.
- EEU721.3. Analyze motor and load characteristics for stability investigation.
- EEU721.4. Select suitable starting, braking and speed control equipments, for DC & IM Drives
- EEU721.5. Simulate various motor-controller combinations for performance determination.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU721.1	1	1	0	0	0	0	0	0	0	0	0	0	2	2	0
EEU721.2	2	1	0	1	0	0	0	0	0	0	0	0	2	2	0
EEU721.3	2	3	0	1	2	0	0	0	0	0	0	0	1	0	0
EEU721.4	2	1	2	0	0	0	0	0	0	0	0	0	1	0	0
EEU721.5	2	2	0	0	3	0	0	0	0	0	0	0	1	2	

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU722A EHV AC TRANSMISSION

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To Provide In-depth understanding of different aspects of Extra High Voltage AC transmission system design and Analysis.
- II. To understand the concept of Voltage gradients of conductors.
- III. To understand the Electrostatic field and its effects over humans, animal and plants.

Extra High Voltage AC Transmission: Introduction to EHV-AC transmission, transmission line trends & preliminary aspects, standard transmission voltages-power handling capacities and line losses mechanical aspects.

Electrostatic Field of EHV Lines: electric shock & threshold currents, capacitance of long object, Effect of Electrostatic field on Human, Animal.

Over Voltages in EHV System: origin & causes, over voltage caused by switching operations, over voltage caused by interruption of low inductive current, over voltage caused by interruption of capacitive currents, Ferro-resonance overvoltage Power frequency voltage control, shunt & series compensation.

Voltage Gradients of Conductors: Electrostatics – field of sphere gap – field of line changes and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub conductors of bundle – Examples.

Lightning: Lightning strokes, Lightning stroke to tower and midspan, Insulation coordination based on lightning.

Traveling Wave Theory: Traveling wave expression and solution- source of excitation-terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines generalized constants-No load voltage conditions and charging current.

Corona Effects: Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram – generation, characteristics - limits and measurements of AN – relation between 1-phase and 3-phase AN levels.

Text Books

1. Extra High Voltage AC Transmission Engineering, Rakosh Das Begamudre ,New Age International(P) Ltd
2. HVAC and DC Transmission, by S. Rao, 3rd edition , Khanna Publishers, 2001

Reference Books

1. Extra high voltage AC Transmission Engineering by Rakosh Das Begamudre , Wiley Eastem LTD.
2. EHV Transmission line Edison-Electric institution.

3. www.nptel.iitm.ac.in

Course Outcomes:

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

- EEU722A.1 Learn about the trends in EHV AC Transmission.
- EEU722A.2 Understand electrostatic field of EHV AC lines.
- EEU722A.3 Study overvoltage phenomenon in EHVAV system.
- EEU722A.4 Lightning phenomenon in EHV AC lines.
- EEU722A.5 Students will understand the effects of corona like Audible noise.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU722A.1	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0
EEU722A.2	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0
EEU722A.3	3	3	2	2	2	0	0	0	0	0	0	0	2	2	0
EEU722A.4	2	3	0	1	2	0	0	0	0	0	0	0	2	2	0
EEU722A.5	2	1	0	0	0	0	0	0	0	0	0	0	1	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU722B HIGH VOLTAGE ENGINEERING

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Course Objectives:

- I. To gain the knowledge in testing of high voltage equipments.
- II. To understand breakdown mechanism of gases, liquid and solid dielectrics.
- III. To describe the principals behind generating high DC-AC and impulse voltages

Mechanism Of Breakdown In Gases: Classification of insulating materials. Gases as insulating media, Ionization & decay process, breakdown in gases, Townsend's law. The streamer mechanism of spark Paschen's law, corona discharge, electronegative gases

Breakdown In Liquid And Solid Dielectrics : Breakdown in pure and commercial liquids, Solid Dielectrics and composite dielectrics, High Voltage bushings, Guarding, Shielding, Field Plotting.

Lightning and Switching over Voltages and Protection: Lightning strokes to lines and towers, mechanism & characteristics. Protection of transmission lines from lightning, Lightning Arrestors. Insulation to co-ordination of HV and EHV transmission line, Power system and substation.

High Voltage and Current Generation: Generation of High D.C, A.C. and Impulse voltages, and Standard impulse wave shapes, Switching Surges, High Impulse Generator

High Voltage And Current Measurement: Peak voltage, Impulse voltage and High Direct current Measurement methods, Non-destructive measurement and testing, High Voltage dielectrics Loss and capacitance measurement, Radio Frequency and partial discharge measurement.

High Voltage Testing: Basic Terminology, Testing – Insulation, Bushings, Cables, Transformers, Surge Diverters and Isolators, Electric Shock and threshold current

Text Book

1. High Voltage Engineering, Naidu M.S. and Kamaraju V Tata McGraw Hill Pub. Co. New Delhi Third Edition

Reference Books

1. High Voltage Engineering, E. Kuffel and W.S. Zaenglo, Pergamon Press
2. EHV AC Transmission Engineering, Rokosh Das Begamudre, Wiley Eastern Ltd. New Delhi.
3. High Voltage Engineering, D.V.Razevig, Khanna Pub. New Delhi
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

Course Outcomes

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

- EEU722.B.1. Demonstrate breakdown mechanism of gases, liquid and solid dielectrics.

EEU722.B.2. Understand lightning, switching over voltages and their protection.

EEU722.B.3. Understand the methods of high voltage and current generation.

EEU722.B.4. Describe measurement techniques for high voltage and current.

EEU722.B.5. Understand basic terminology of high voltage testing.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU722.B.1	2	1	1	0	1	2	1	0	0	0	0	0	1	0	0
EEU722.B.2	2	1	1	0	1	2	1	0	0	0	0	0	2	0	0
EEU722.B.3	2	2	2	0	2	1	1	0	0	0	0	0	2	1	0
EEU722.B.4	2	2	2	0	1	2	0	0	0	0	0	0	2	2	0
EEU722.B.5	2	1	2	0	1	-0	0	0	0	0	0	0	2	2	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU722C AI AND MACHINE LEARNING

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To understand fuzzy logic, ANN
- II. To understand machine learning and algorithm
- III. To understand Probability and Bayes learning

Biological Foundations to Intelligent Systems: Artificial Neural Networks, Single layer and Multi layer Feed Forward ANN, LMS and Back Propagation Algorithm, Feedback networks and Radial Basis Function Networks.

Fuzzy Logic: Knowledge Representation and Inference Mechanism, De fuzzification Methods, System Identification using Fuzzy and Neural Network

Introduction to Machine Learning: Basic definitions, types of learning, designing a learning system, perspectives and issues, hypothesis space and inductive bias, evaluation, cross- validation. Linear regression, Decision trees, Splitting Criteria, Issues in decision tree learning, over-fitting and evaluation, nearest neighbor methods.

Neural Network: Perceptron, multilayer network, back propagation, introduction to deep neural network. Dimensionality Reduction: Feature reduction, Principal Component Analysis, Fischer's Discriminant Analysis. Probability and Bayes learning, Naive Bayes Model, Logistic Regression, Reinforcement learning.

Support Vector Machine: Kernel function and Kernel SVM, Clustering: partitioning, k-means clustering, hierarchical clustering, and Case studies

Text Books:

1. An Introduction to ANN, J M Zurada Jaico Publishing House
2. Introduction to Machine Learning, Ethem Alpaydin Second Edition, The MIT Press, 2010.

Reference Books:

1. Neural Networks, Simon Haykins, Prentice Hall
2. Machine Learning, Tom Mitchell, McGraw-Hill

Course Outcomes:

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

- EEU722C.1. Learn the concepts of biological foundations of artificial neural networks.
EEU722C.2. Learn Feedback networks and radial basis function networks and fuzzy logics
EEU722C.3. Identify fuzzy and neural network
EEU722C.4. Explain the basic concepts of machine learning
EEU722C.5. Demonstrate fundamental issues and challenges of machine learning algorithms

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU722C.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
EEU722C.2	1	1	2	0	2	0	0	0	0	0	0	0	0	2	0
EEU722C.3	1	1	2	2	0	0	0	0	0	0	0	0	0	2	0
EEU722C.4	1	2	2	2	1	0	0	0	0	0	0	0	0	0	1
EEU722C.5	1	3	0	0	2	0	0	0	0	0	0	0	1	0	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU722 D DATA STRUCTURES

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To Apply software development life cycle in software industry
- II. To Identify the importance of software requirements problem to understand the requirement management process Imparting the knowledge of the memory management
- III. Design and analyze effective use of UML using different design strategies

Review of Basic Concepts: Abstract data types, Data structures, Algorithms, Big Oh, Small Oh, Omega and Theta notations, Solving recurrence equations, Master theorems, Generating function techniques, Constructive induction

Advanced Search Structures: for Dictionary ADT Splay trees, Amortized analysis, 2-3 trees, 2-3-4 trees, Red-black trees, Randomized structures, Skip lists, Treaps, Universal hash functions, Tire ; Hashing: Simple tabulation hashing; chaining, dynamic perfect hashing, linear probing, cuckoo hashing

Union Find Related Structures: Union-Find: Merging Classes of a Partition, Union-Find with Copies and Dynamic Segment Tree, List Splitting, Problems on Root-Directed Trees, Maintaining a Linear Order

Data Structures for Partition: ADT Weighted union and path compression, Applications to finite state automata minimization, Code optimization

Data Structure Transformations: Making Structures Dynamic, Making Structures Persistent Computational Geometry Geometric data structures, Plane sweep paradigm Convex Hull Different Paradigms and Quickhull , Dual Transformation and Applications , Lower Bounds on Algebraic tree model , Point Location and Triangulation

Text Books:

1. Introduction to Algorithms; 3rd Edition; by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein; Published by PHI Learning Pvt. Ltd. ; ISBN-13: 978-0262033848 ISBN-10: 0262033844
2. Algorithms; 4th Edition; by Robert Sedgewick and Kevin Wayne; Pearson Education, ISBN-13: 978-0321573513
3. Advanced Data Structures, Peter Brass, Cambridge University Press, ISBN-13: 978-0521880374

Reference Books:

1. Algorithms; by S. Dasgupta, C.H. Papadimitriou, and U. V. Vazirani Published by McGraw-Hill, 2006; ISBN-13: 978-0073523408 ISBN-10: 0073523402

2. Algorithm Design; by J. Kleinberg and E. Tardos; Published by Addison-Wesley, 2006; ISBN-13: 978-0321295354 ISBN-10: 0321295358
3. An Integrated Approach to Software Engineering, Pankaj Jalote Narosa publication house.

Course Outcomes:

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

EEU722D.1. Describe the data type and structure.

EEU722D.2. Apply data structure for minimization and code optimization

EEU722D.3. Describe the advanced search structures

EEU722D.4. Devise the procedure to assure the quality and maintainability of the product before and after deployment

EEU722D.5. Summarize different testing strategies

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU722D.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
EEU722D.2	1	1	2	0	2	0	0	0	0	0	0	0	0	2	0
EEU722D.3	1	1	2	2	0	0	0	0	0	0	0	0	0	2	0
EEU722D.4	1	2	2	2	1	0	0	0	0	0	0	0	0	0	1
EEU722D.5	1	3	0	0	2	0	0	0	0	0	0	0	1	0	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU722E ENERGY STORAGE SYSTEMS

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Understand energy storage systems.
- II. Study the technology in energy storage systems.
- III. Study the types of energy storage systems.

Fundamentals of Energy Storage Systems: Introduction and Fundamentals of energy storage, energy density, power density; Electrochemical storage components; Super capacitors; Hydraulic storage; Flywheels; Compressed air energy storage; concept of load dispatch centre, effect of renewable integration in to grid.

Technologies in Energy Storage Systems: Overview of energy storage in the Thermal, Chemical and Electrochemical systems, Electrical Efficiency of energy storage systems, Electrical energy storages: Batteries, Super capacitors, super conducting Magnetic Energy Storage (SMES), charging methodologies, State of Charge (SoC), State of Health (SoH) estimation techniques. Hydrogen production and storage, fuel cells.

Types of Energy Storage Systems: Mobile storage system: electric vehicle, Grid to Vehicle (G2V) and Vehicle to grid (V2G). Hybrid Energy storage systems: configurations and applications. Storage for renewable energy systems: Solar energy, Wind energy, fuel cells. Energy storage in Micro grid and Smart grid. Energy Management with storage systems, Increase of energy conversion efficiencies by introducing energy storage.

Operation and Maintenance of Energy Storage Systems: Model of energy storage systems and its management, Electric Vehicle charging facility, Hybrid Energy Storage System (HESS) in micro grid and smart grid, microbial fuel cell, hydrogen fuel cell.

Other Energy Storage Systems and Econometric Analysis of Energy Storage Systems: Performance advantages and disadvantages of lead acid batteries, Inadequacy of existing technologies, Next generation of li-based batteries, Battery Management System (BMS), Electric Vehicles battery considerations. Hybrid Charging (grid and solar photovoltaic). Return on Investment (ROI) and Project Analysis involving Energy Storage Systems.

Text Books:

1. Energy storage devices for renewable energy – based systems by Nihal Kularatna and Kosala Gunawardane, Academic Press by Elsevier -Second Edition 2021.
2. Grid-scale energy storage systems and applications by Fu-Bao Wu, Bo Yang and Ji-Lei Ye , Academic Press by Elsevier -Second Edition 2021.

Reference Books:

1. Energy Storage: Fundamentals, Materials and Applications by Robert A. Huggins; Springer, 2010.

- Electric Energy Storage Systems: Flexibility Options for Smart Grids, by Pio Lombardi, Przemyslaw Komarnicki, and Zbigniew Antoni Styczynski, Springer 2017.
- Energy Storage Systems, by S. Kakac, Birol Kilic, 1989
- Energy Storage for Sustainable Microgrid, by David Wenzhong Gao, Academic Press Elsevier, 2015.
- Energy Storage for Power Systems by A.G. Ter-Gazarian, Second Edition, The Institution of Engineering and Technology (IET) Publication, UK, (ISBN - 978-1-84919-219-4), 2011.
- Energy Storage Science and Technology” by A. R. Pendse, SBS Publishers & Distributors Pvt. Ltd., New Delhi, (ISBN - 13:9789380090122), 2011.

Course Outcomes:

Students will be able to

- EEU722E.1. Explain the different energy storage systems.
- EEU722E.2. Apply the electrical efficient energy storage systems.
- EEU722E.3. Implement the types of electrical storage systems.
- EEU722E.4. Operate and maintain model of energy storage systems.
- EEU722E.5. Analyze the economic ways in energy storage systems.

CO – PO – PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU722E.1	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU722E.2	2	1	2	1	0	0	0	0	0	0	0	0	2	0	0
EEU722E.3	2	1	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU722E.4	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU722E.5	2	1	2	2	0	0	0	0	0	0	0	0	2	0	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU723A POWER SYSTEM MODELING

Teaching Scheme: 03 L+ 01T Total: 04

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

Students will be able to:

- I. Study analysis of electromechanical machines
 - II. Development of mathematical models for synchronous machine
 - III. Modeling of an induction motor
 - IV. Understand Parks Transformation
 - V. Modeling of EHV AC and HVDC and loads
- Principle of unified machine theory, generalized torque equation
- Performance evaluation of DC machine and speed control
- Three phase induction motor- transformation methods, stationary, rotor and synchronous frames and corresponding equivalent circuits.
- Three phase synchronous motor: representation, Park transformation
- EHV AC and HVDC Transmission line modelling, Modelling of power system loads (Basic load modelling concepts)

Text Books:

1. "Analysis of Electric Machinery", P. C. Krause, McGraw Hill, New York, 1987
2. "Dynamic simulation of Electrical Machinery using Matlab/Simulink", Chee Mun Ong, Prentice Hall PTR, 1997.

Reference Books

1. "Vector Control of A.C. Machines", P. Vas, Clarendon Press, Oxford, 1990.
2. "Power Electronic Control of AC motors" J.M. D. Murphy and F.G. Turnbull, Pergamum Press, 1988.
3. "Control of Electrical Drives", W. Leonhard, Springer Verlag, 1985.

Course Outcomes:

Students will be able to:

- EEU723A.1. Analyze electromechanical devices and, machines
- EEU723A.2 Use reference frame theory to study and analyze the behavior of induction and synchronous machines
- EEU723A.3 Calculate the machine inductances for use in machine analysis
- EEU723A.4 Model the electrical machine from the terminal junction with transmission systems

CO – PO – PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU723A.1	2	2	--	1	2	--	--	--	--	--	--	--	1	1	1
EEU723A.2	2	1	--	2	2	--	--	--	--	--	--	--	1	2	2
EEU723A.3	1	3	--	2	2	--	--	--	--	--	--	--	1	3	2
EEU723A.4	1	3	--	2	2	--	--	--	--	--	--	--	2	2	2
EEU723A.5	1	1	--	3	2	--	--	--	--	--	--	--	--	1	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU723B SMART GRID

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To study the concept of smart grid.
- II. To study Information and Communication technology
- III. To study the renewable energy integration

Introduction to Smart Grid: Concept, definitions, difference between conventional and smart grid, challenges in smart grid implementation, Overview of the technologies required for the Smart Grid

Information and Communication Technology: Communication requirements in smart grid, overview of smart grid standards, Wired and wireless communication, Zigbee, Wireless mesh, Cellular Network Communication, Power line Communication, Digital Subscriber Lines, Wi-Max, Wide Area Network, Neighborhood Area Network, and Home Area Network, information technology, cyber security, standards, data handling, interoperability.

Smart Substation: International Electro mechanical Communication 61850 standards and benefits, IEC Generic Object Oriented Substation Event - GOOSE, IEC 61850 Substation model, Intelligent Electronic Devices integration, Substation LAN, WAN, SCADA, Substation automation.

Smart Distribution Systems and Energy Storage: Introduction to Smart Meters, Real time pricing, Smart appliances, Automatic meter reading(AMR), Demand response, Battery storage, Plug in Hybrid electric vehicles, compressed air, pumped hydro, ultra capacitors, fly wheels, fuel cells.

Renewable Energy Integration: Carbon Footprint, Renewable Resources: Wind and Solar, Microgrid Architecture, Modeling Smart Grids 61 PV and wind systems, Tackling Intermittency, Issues of interconnection, protection & control of microgrid, Islanding.

Text Books:

1. Smart Grid Technology and Applications JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama Wiley, March 2012
2. Smart Grids, Jean Claude Sabonnadière, NouredineHadjsaïd, Wiley Blackwell,

Reference Books:

1. Smart Grid: Fundamentals of Design and Analysis, James Momoh, IEEE Press Series on Power Engineering
2. Integration of Green and Renewable Mohammad N. Marwali, Min Dai Wiley, November 2009
3. Smart Grids (Power Engineering) Stuart Borlase CRC Press, October 2012

Course Outcomes:

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

- EEU723B.1. Identify The various aspects of the smart grid, including technologies, components, architectures and applications
- EEU723B.2. Understand the issues and challenges involved Analyze different data mining primitives for the functions.
- EEU723B.3. Study Current initiatives in the development of smart grid at national and international level implement the different algorithms of classification and prediction.
- EEU723B.4. Understand the role of communication and information technology in smart grid Implement the different algorithms for data clustering.
- EEU723B.5. Study the micro grid and interconnection issues

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU723B.1	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU723B.2	2	1	2	1	0	0	0	0	0	0	0	0	2	0	0
EEU723B.3	2	1	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU723B.4	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU723B.5	2	1	2	2	0	0	0	0	0	0	0	0	2	0	0

0- Not correlated 1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU723C AVANCED MICROPROCESSORS

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Imparting the knowledge about the complete hardware of the advanced microprocessor
- II. Imparting the knowledge of the memory management
- III. To study Pentium processors

8086 Microprocessor Architecture: Segmented Memory - Addressing Modes - Instruction Set - 8086 Assembly Language Programming - 8087 Numerical Data Processor Architectural details - Data types - Floating point Operations - 8087 Instructions.

Architectural Details of 80386 Microprocessor: Special registers - Memory management - Operation in protected mode and virtual 80386 modes - Memory paging mechanism - Special instructions of 80386 - Architectural details of 80486 - Special registers - Additional instructions - Comparison of 80386 and 80486 processors.

Introduction to Pentium Processor: Architectural features - Comparison with the workstations - Branch prediction logic - cache structure. - Special Pentium Registers. Memory management - virtual mode of operation - Comparison with the previous processors. Features of Pentium-II, Pentium-III and Pentium Pro-processors.

RISC Microprocessors : RISC Vs CISC – RISC Properties – DEC Alpha AXP Architecture - Power PC – Architecture - Programming Model – Data Types – Addressing Modes – Instruction Set. Sun SPARC – Architecture – Data Types – Instruction Sets - Features of MIPS, AMD

Text Books:

1. Barry B Brey “Intel Microprocessors : 8086/88, 80186/188, 80286, 80386, 80486, Pentium, Pentium – II, Pentium – III and Pentium – IV, Architecture, Programming & Interfacing”, Pearson Education, 2003

Reference Books:

1. Advanced Microprocessors and Interfacing, Badri Ram, Tata McGraw Hill
2. Advanced Microprocessors & Peripherals, A.K. Ray & K.M. Bhurchandi

Course Outcomes:

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

- EEU723C.1. Describe the architecture and operation of the 8086, 80386 and RISC microprocessor family.
- EEU723C.2. Design interfacing for memory devices to the 8086 and 80386 including dynamic RAM.
- EEU723C.3. Design a software system using engineering principles, software engineering and the assembly language
- EEU723C.4. Analyze abstract problems and apply a combination of hardware and software to address the problem

EEU723C.5. Understand concept of multi core processors

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU723C.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
EEU723C.2	1	1	2	0	2	0	0	0	0	0	0	0	0	2	0
EEU723C.3	1	1	2	2	0	0	0	0	0	0	0	0	0	2	0
EEU723C.4	1	2	2	2	1	0	0	0	0	0	0	0	0	0	1
EEU723C.5	1	3	0	0	2	0	0	0	0	0	0	0	1	0	0

0- Not correlated 1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU723D ALGORITHMS

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objective-

- I. Study the asymptotic performance of algorithms.
- II. Write rigorous correctness proofs for algorithms.
- III. Understand a familiarity with major algorithms and data structures.
- IV. Understand important algorithmic design paradigms and methods of analysis.
- V. Understand efficient algorithms in common engineering design situations.

Overview of Algorithms: Introduction, Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; Illustrations

of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Algorithms Topologies: Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Tractable and Intractable Problems: Computability of Algorithms, Computability classes P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and reduction techniques.

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Books:

1. Introduction to Algorithms, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, 4TH Edition, MIT Press/McGraw-Hill.

Reference Books:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,
3. Michael T Goodrich and Roberto Tamassia, Wiley.
4. Algorithms 0 A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Course Outcomes:

Students will able to

- EEU723D.1. Analyze the algorithms.
- EEU723D.2. Choose the algorithms strategies.
- EEU723D.3. Apply the algorithms topologies.
- EEU723D.4. Illustrate the tractable and intractable problem using algorithms.
- EEU723D.5. Use the advanced topics in algorithms.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU723D.1	2	2	1	1	1	0	0	0	0	0	0	0	1	0	0
EEU723D.2	2	1	2	2	2	0	0	0	0	0	0	0	2	0	0
EEU723D.3	1	2	2	1	2	0	0	0	0	0	0	0	1	0	0
EEU723D.4	2	1	2	2	1	0	0	0	0	0	0	0	2	0	0
EEU723D.5	2	2	2	1	1	0	0	0	0	0	0	0	1	0	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU723 E POWER SYSTEM TRANSIENTS

Teaching Scheme: 03 L+0 T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

Students will be able to understand:

- I. Generation of switching transients and their control using circuit
- II. Mechanism of lightning strokes and the production of lightning surges.
- III. Propagation, reflection and refraction of travelling waves.
- IV. Voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

Introduction to Transients:

Importance of the study of transients causes for transients. RL circuit transient with sine wave excitation, basic transforms of the RLC circuit transients. Different types of power system transients, effect of transients on power systems, role of the study of transients in system planning.

Switching Transients:

Over voltages due to switching transients, resistance switching and the equivalent circuit for interrupting the resistor current, load switching and equivalent circuit ,waveforms for transient voltage across the load and the switch , normal and abnormal switching transients. Current suppression, current chopping, effective equivalent circuit. Capacitance switching, effect of source regulation, capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients, ferro resonance.

Lightning Transients:

Review of the theories in the formation of clouds and charge formation, rate of charging of thunder clouds, mechanism of lightning discharges and characteristics of lightning strokes, model for lightning stroke , factors contributing to good line design, protection using ground wires, tower footing resistance, Interaction between lightning and power system.

Traveling Waves on Transmission Line:

Computation of transients, transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept, step response, Bewely's lattice diagram, standing waves and natural frequencies, reflection and refraction of travelling waves.

Transients in Integrated Power System:

The short line and kilometric fault, distribution of voltages in a power system, Line dropping and load rejection, voltage transients on closing and reclosing lines, over voltage induced by faults, switching surges on integrated system Qualitative application of EMTP for transient computation.

Course Outcomes:

Students will be able to:

EEU723E.Understand and analyze switching and lightning transients.

- EEU723E.2 Acquire knowledge on generation of switching transients and their control.
- EEU723E.3 Analyze the mechanism of lightning strokes.
- EEU723E.4 Understand the importance of propagation, reflection and refraction of travelling waves.
- EEU723E.5 Understand the concept of circuit breaker action, load rejection on integrated power system.

Text Books:

1. 'Electrical Transients in Power Systems', Allan Greenwood, Wiley Inter Science, New York, 2nd Edition, 1991.
2. "Electromagnetic transients in Power System", Pritindra Chowdhari, John Wiley and Sons Inc., Second Edition, 2009.
3. 'Power System Transients – A statistical approach' C.S. Indulkar, D.P. Kothari, K. Ramalingam, PHI Learning Private Limited, Second Edition, 2010.

Reference Books:

1. M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU723E.1	2	2	0	1	2	0	0	0	0	0	0	0	1	1	1
EEU723E.2	2	1	0	2	2	0	0	0	0	0	0	0	1	2	2
EEU723E.3	1	3	0	2	2	0	0	0	0	0	0	0	1	3	2
EEU723E.4	1	3	0	2	2	0	0	0	0	0	0	0	2	2	2
EEU723E.5	1	1	0	3	2	0	0	0	0	0	0	0	0	1	3

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU733 A FUNDAMENTAL OF ELECTRICAL DRIVES

Teaching Scheme: 03 L+ 00T Total: 03
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE
Duration of ESE: 2hrs.30min

Credits: 03
Total Marks: 100

Course Objectives:

- I. To introduce the basic concepts of electrical machines and drives.
- II. To explicate different performance characteristics of AC and DC motor.
- III. To initiate studies in solid state control of AC and DC motors
- IV. To comprehend procedure for selection of motor for different applications

Concept of General Electric Drives: Classification and comparison of electric drive system, cooling and heating of electric motors, Theory and working principle of power transistors, power MOSFET, SCR.

Basic Characteristics of DC Motors: Torque equation, modified speed–torque characteristics, starting and braking of electric DC motors, comparison of mechanical and electric braking methods, conventional speed control methods.

Classification of AC Motors: Construction, types, characteristics of 3-phase IM, torque equation, applications, starting and braking of 3-phase IM, conventional speed control methods. Thyristorised stator voltage control of 3-phase IM, (V/F) control, slip–power recovery scheme, thyristorised armature voltage control of DC motors using phase control and thyristorised chopper.

Introduction, principle, construction and working of DC servo motors, stepper motors, brushless DC motors, classification of 1-phase IM, construction, principle, working and applications, principle and working of Universal motor, linear IM

Industrial Applications: Classes of duty, selection of an electric drive for particular applications such as steel mill, paper mill, cement, textile mill, electric traction, coal mining, etc.

Text Books:

1. Electric machines, I.J. Nagrath and D.P.Kothari, 2nd Edn, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2008.
2. Electrical Technology (AC and DC drives) Vol-II and Vol-III B.L .Thereja, 4th Edn. Dhanpat Rai and Sons, 2002.

Reference Books:

1. Electric Motor Drives-modeling, analysis and control, R. Krishnan, 1st Edn, Pearson Edu, 2006.
2. Utilization of Electrical Power, R.K. Rajput, 5thEdn, Laxmi publications, 2007
3. Fundamentals of Electrical Drives, G. K. Dubey, Narosa Publishing House, 2005

Course Outcomes:

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

EEU724.A.1 Understand the basic concepts of electric drives.

EEU724.A.2 Present different performance characteristics of AC and DC motors.

EEU724.A.3 Describe solid state controls for AC and DC motors

EEU724.A.4 Portray construction and working of different modern electric machines.

EEU724.A.5 Select motors for different applications

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU724.A.1	1	2	0	0	0	0	0	0	0	0	0	0	1	1	0
EEU724.A.2	1	2	0	0	0	0	0	0	0	0	0	0		2	0
EEU724.A.3	0	3	0	1	0	0	0	0	0	0	0	0	1	1	0
EEU724.A.4	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
EEU724.A.5	0	0	0	1	2	0	0	0	0	0	0	0	0	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU733 B ELECTRICAL ESTIMATING AND COSTING

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To summarize the importance of estimation, specification and earthing.
- II. To prepare the schedule of materials with specifications and estimates for service mains.
- III. To enable the students to prepare the schedule of materials with specifications and estimates for different types of electrical installations.

Introduction: Meaning of estimation, purpose of estimating and the factors to be considered while preparing estimations, qualities of a good estimator, Meaning of specification, importance of specification and the factors to be considered. Meaning of standardization and its advantages. Meaning of overhead charges, stock incidental charges, contingencies, supervision charges, labour charges, Inspection/Inspectorate charges, transportation charges and miscellaneous charges. Meaning of tender/tender notice, quotation, comparative statement, purchase order and work order. Importance / purpose of IE Act and IE Rules. Meaning of earthing, touch potential and step potential, necessity of earthing, Points to be earthed, factors influencing earth resistance, methods of reducing earth resistance, standard values of earth resistance for various installations, method of selecting the size of earth conductor, types /methods of earthing, Pipe earthing-diagram, specifications of pipe earthing, Plate earthing-diagram and specifications of plate earthing.

Service Mains: Meaning of service mains, code of Practice for service mains, types of service mains- Over Head Service Mains -materials and specifications, UG Service Mains - materials and specifications, Standard wire size table, current ratings for Aluminum, copper conductors and selection of size of conduit pipe as per the size and number of wires. Load calculation, selection of size and type of conductor/UG cable, discrimination of size of protective devices, Quantity calculation, schedules of materials and estimates for single phase OH service connection, three phase OH service connection, single phase UG service connection and three phase UG service connection

Lighting Installations: Interior Wiring types and their applications, factors to be considered while selecting the type of wiring system, materials required for Interior wiring and their specifications, Code of Practice for Lighting Installations, method of deciding the number of sub-circuits, calculating the quantity of wiring materials and accessories for the Interior Wiring, load calculations for a residential buildings, size of conductors, main switch, sub switches and protective devices. Draw wiring plan for AEH Installation, concept of horizontal run, vertical rise and vertical drop. Prepare the schedule of materials for providing lighting and heating circuits and their estimates. Procedure for converting lighting to AEH installation

Power Installations: Code of Practice for Power Installations, materials required for power circuit wiring and their specifications, Prepare the layout diagram of machines showing

clearances as per IS standards, draw wiring plan of the Power circuit for workshops, Decide the type of wiring.

system, load calculations, determine the size of conductors, main switch, Isolators, sub switches and protective devices, Draw the SLD of Power Distribution Scheme showing grading/discrimination of ratings of protective devices, Prepare the schedule of materials with specifications for workshops and their estimates, Determine the rating of motor for IP set and the concept (only) of pump house wiring.

Distribution Lines and Transformer Substations: Code of practice for Distribution Lines and Transformer centre, types of transformer centres - Pole mounted, plinth mounted, indoor and outdoor types. Determining the rating of Distribution Transformer. Write Specifications of the Distribution Transformer. Draw the SLD of a Transformer centre indicating the size of protective devices, Prepare the schedule of equipments /Materials with specifications for a 11KV/415V, 100 KVA transformer centre and their estimates, 415 V LT line materials and specifications, method of calculating various LT line materials (only). Prepare the schedule of materials (only) for 3 phase 4 wire LT line, 11 KV HT Line-materials and their specifications, method of calculating various HT line materials and tapping structure, TOPO sheet and its use, Concept of combined estimates. Prepare the schedule of materials (only) for 11 KV single circuits. HT line for Rural Electrification.

Transmission Lines and Substations: Code of practice for Transmission lines and substations, transmission line materials and their specifications, types of Towers, ACSR conductors and Number of Disc insulators in suspension string, strain string, span and height of towers for 66 KV, 110 KV, 220 KV transmission lines, concept of single circuit and double circuit transmission lines, method of calculating the Quantity of transmission line materials, Prepare the schedule of materials (only) for 66 KV, 110 KV and 220 KV single circuit transmission lines. 66KV/11KV, 5 MVA Substations- Single Line diagram, list of Electrical equipments/ materials (only) and their specifications.

Text Books:

1. Electrical Design Estimating and Costing, Raina.K.B.& Bhattacharya. S.K. New Age International

Reference Books:

1. A Course in Electrical Installation, Estimating & Costing, J B Gupta, S K Kataria & Sons.
2. Electrical estimating and costing, Surjith Singh, Danpat Rai & Co.

Course Outcomes:

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

- EEU724B.1 Understand various types of materials required for wiring.
- EEU724B.2 Comprehend the estimation of a domestic installation.
- EEU724B.3 Know different systems of earthing.
- EEU724B.4 Comprehend the estimation of industrial installations.
- EEU724B.5 Comprehend the estimation of substations.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU724B.1	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0
EEU724B.2	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0
EEU724B.3	3	3	2	2	2	0	0	0	0	0	0	0	2	2	0
EEU724B.4	2	3	0	1	2	0	0	0	0	0	0	0	2	2	0
EEU724B. 5	2	1	0	0	0	0	0	0	0	0	0	0	1	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU725A HVDC AND FACTS

Teaching Scheme: 03 L+0 T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

Students will be able to:

- I . To learn the active and reactive power flow control in power system
- II. To understand the need for static compensators'
- III. To develop the different control strategies used for compensation

Introduction to HVDC:

Introduction of DC Power transmission technology – Comparison of AC and DC transmission, Application and Description of DC transmission system, planning for HVDC transmission, Modern trends in DC transmission, Types of HVDC Systems.

Analysis of HVDC Converters:

Pulse Number-Choice of converter configuration, simplified analysis of Gratez circuit, 12-pulse converter based HVDC systems and their characteristics, Control of Converters.

Harmonics and Filters:

Introduction – Generation of Harmonics, Design of AC filters and DC filters, HVDC light and HVDC PLUS (Power Universal Link), Series and Parallel operation of converters.

Introduction to FACTS:

The concept of flexible AC transmission – reactive power control in electrical power transmission lines, uncompensated transmission line, Introduction to FACTS devices and its importance in transmission Network, Introduction to basic types of FACTS controllers, Comparison of HVDC and FACTS.

FACTS Controllers:

Principles of series and shunt compensation, description of static var compensators (SVC), thyristor controlled series compensators (TCSC), static phase shifters (SPS), static synchronous series compensator (SSSC), STATCOM.

Text Books:

- 1." HVDC Power Transmission System", K. R. Padiyar, Wiley Eastern Limited, New Delhi , First Edition 1990.
2. "Understanding FACTS: Concepts and Technology of FACTS Systems", N.G. Hingorani, IEEE Press, 2000

Text Books :

1. " Reactive Power Control in Electrical System", T.J.E. Miller, John Wiley and Sons, New York, 1982.
2. "FACTS Controller in Power Transmission and Distribution", K.R. Padiyar New Age International (P) Ltd, 2007.

References Books:

1. " High voltage Direct Current Transmission", J. Anillaga, Peter Pregnnus, London 1983.

2. <http://www.nptel.iitm.ac.in>

3. www.ocw.mit.edu

Course Outcomes:

On completion of the course the students will be able to:

EEU725A.1 Analyze the different control strategies for power flow using HVDC devices.

EEU725A.2. Understand the working of different HVDC Converters

EEU725A.3.Study the working of Harmonics & filters

EEU725A.4 Understand the concept of FACTS.

EEU725A.5 Develop analytical modeling and analysis FACTS Controllers.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU725A.1	2	2	1	1	2	1	1	0	0	0	0	0	1	1	1
EEU725A.2	2	2	0	2	2	0	0	0	0	0	0	0	1	2	2
EEU725A.3	2	3	0	2	2	0	0	0	0	0	0	0	1	3	2
EEU725A.4	2	3	1	2	2	1	0	0	0	0	0	0	2	2	2
EEU725A.5	2	2	0	3	2	0	0	0	0	0	0	0	0	1	3

0- Not correlated 1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU725B POWER QUALITY ISSUES & MITIGATION

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives-

- I. To study the power quality problems in distributed systems.
- II. To understand the compensation techniques.
- III. To identify the filter types to mitigate power quality problems.

Basic Concepts of Power Quality: Power quality problems in distribution systems, definitions, power quality standards, Harmonics, Harmonic creating loads & its modeling

Passive Shunt and Series Compensation: Introduction, State of The Art on Passive Shunt and Series Compensators, Classification of Passive Shunt and Series Compensators, Principle of Operation Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators.

Active Shunt Compensation: Introduction, State of the art on DSTATCOM, Classification of DSTATCOM, Principle of operation and control of DSTATCOM, Analysis and Design of DSTATCOM.

Active Series Compensation: Introduction, State of the art on Active Series Compensators, Classification of Active Series Compensators, Principle of Operation of Active Series Compensators, Analysis and Design of Active Series Compensators.

Mitigation of Power Quality Problems: Harmonics Propagation, Series and Parallel Resonance, Harmonic Power Flow, Mitigation of Harmonics, Filters, Active Filters, Shunt and Series Hybrid Filters.

Text Books:

1. "Electrical Power Systems Quality", Dugan Roger, McGraw-Hill Edition 2002.
2. "Power quality problems and mitigation techniques", Bhim Singh, Ambrish Chandra and Kamal-Al-Haddad, Wiley Edition 2015.

Reference Books:

1. "Electric power quality", G.T. Heydt McGraw-Hill Professional, 2007.
2. "Understanding Power Quality Problems", Math H. Bollerr IEEE Press, 2000.

Course Outcomes:

Students will able to study-

- EEU725B.1. Define the power quality problem in distribution systems.
- EEU725B.2. Illustrate the comparative analysis in passive shunt and series compensation.
- EEU725B.3. Analyze the active shunt compensation technique.
- EEU725B.4. Explain the active series compensation technique.
- EEU725B.5. Formulate the different types of filter to mitigate power quality issues.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU725B.1	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU725B.2	2	2	1	2	0	0	0	0	0	0	0	0	2	0	0
EEU725B.3	2	1	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU725B.4	2	2	1	1	0	0	0	0	0	0	0	0	2	0	0
EEU725B.5	1	2	2	2	0	0	0	0	0	0	0	0	2	0	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU725 C DIGITAL CONTROL SYSTEM

Teaching Scheme: 03 L + 00 T

Total: 03 Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min

Course Objectives:

- I. To understand digital control the systems with nonlinear behaviours.
- II. To learn fundamentals and applications of digital control for multidisciplinary engineering problems.
- III. To develop mathematical models for controlling system

Discrete Representation of Continuous Systems:

Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modeling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

Discrete System Analysis:

Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.

Stability of Discrete Time System:

Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

State Space Approach for Discrete Time Systems:

State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.

Design of Digital Control System:

Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

Discrete Output Feedback Control:

Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems.

TextBooks:

1. K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
3. G. F. Franklin, J. D. Powell and M. L. Workman, " Digital Control of Dynamic Systems", Addison-Wesley, 1998.
4. B.C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980.

Reference Books :

1. Hemchandra Madhusudan Shertukde, "Digital Control Applications Illustrated with MATLAB" 2015, CRC Press
2. Zito Landau, "Digital Control Systems : Design, Identification and Implementation,

- 1/E", Springer-Verlag
3. V. I. George, C.P. Kurian, "Digital Control Systems 1/E", Cengage Learning
 4. Kavita Singh, Rashmi Vashisth, "Digital Control System", Galgotia Publications
 5. <http://www.nptel.iitm.ac.in/>
 6. www.ocw.mit.edu

Course Outcomes:

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

- EEU725C.1. Obtain discrete representation of LTI systems.
- EEU725C.2. Analyze stability of open loop and closed loop discrete-time systems
- EEU725C.3. Design and analyze digital controllers.
- EEU725C.4. Design state feedback and output feedback controllers.
- EEU725C.5. Learn fundamentals of intelligent/smart control systems used for industrial automation.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU725C.1	1	1	0	0	0	0	0	0	0	0	0	0	2	2	0
EEU725C.2	2	1	0	1	2	0	0	0	0	0	0	0	2	2	2
EEU725C.3	1	3	0	1	2	0	0	0	0	0	0	0	1	0	0
EEU725C.4	2	1	2	2	0	0	0	0	0	0	0	0	1	0	0
EEU725C.5	1	2	0	0	3	0	0	0	0	0	0	0	1	2	

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU725D COMPUTER NETWORK

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Develop an understanding of modern network architectures from a design and Performance perspective.
- II. Introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- III. Provide an opportunity to do network programming
- IV. Provide a WLAN measurement ideas.

Data Communication Components: Representation of data and its flow Networks,, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth Utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

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.

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

Text Books:

1. Data Communication and Networking, Behrouz A. Forouzan, 4th Edition, McGraw-Hill.
2. Data and Computer Communication William Stallings, , 8th Edition, Pearson Prentice Hall India.

Reference Books:

1. Computer Networks, Andrew S. Tanenbaum, 8th Edition, Pearson New International Edition.
2. Internetworking with TCP/IP Douglas Comer, Prentice, Volume 1, 6th Edition Hall of India.

3. TCP/IP Illustrated W. Richard Stevens, Addison-Wesley, , Volume 1, United States of America.

Course Outcomes:

- EEU725D.1 Explain the functions of the different layer of the OSI Protocol.
- EEU725D.2 Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
- EEU725D.3 Design a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) based on the market available component
- EEU725D.4 Developed the network programming for a given problem related TCP/IP protocol.
- EEU725D.5 Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU725D.1	2	2	1	2	1	0	0	0	0	0	0	0	0	0	0
EEU725D.2	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0
EEU725D.3	2	1	2	2	1	0	0	0	0	0	0	0	0	0	0
EEU725D.4	2	2	1	2	2	0	0	0	0	0	0	0	0	0	0
EEU725D.5	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU725E POWER SYSTEM PLANNING AND DESIGN

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To study the concept of power system planning.
- II. To design EHV lines
- III. To study the insulation coordination

Transmission lines design : Requirements of transmission lines, selection of voltage for high-voltage transmission lines, choice of conductors, spacing of conductors, corona, insulators, specifications of transmission lines, surge impedance loading of transmission lines, electrical design of transmission lines, main considerations in the mechanical design of transmission lines, sag-tension relation, stringing of transmission lines, towers Design of **EHV transmission lines :** transmission of electric power at extra high voltage, design considerations of EHV lines, selection and spacing of conductors, corona, radio and television interference, insulation coordination, towers

Design of distribution systems: Development of a distribution plan, transmission and distribution systems, types of distribution systems arrangements, primary distribution design, secondary distribution design distribution substations, calculation of distributor sizes: voltage drops, voltage regulation, Lamp flicker.

Design of power system: Introduction, selection of sizes and location of generating stations, selection and specifications of transmission lines, sizes and location of substations, interconnection

Power System Earthing : Objectives, definitions, tolerable limits of body currents, soil resistivity, earth resistance, tolerable step and, actual step and touch voltage, design of earthing grid, concrete encased electrodes, tower footing resistance, measurement of earth resistance R, measurement of soil resistivity, impulse behavior of earthing system.

Insulation Co-ordination: Introduction, definitions, determination of line insulation, B.I.L and insulation levels of sub-station equipment, lightning arrester selection, power system over voltages, tentative selection of arrestor voltage ratings, selection of arrestor discharge currents, arrestor discharge voltage, establishment of impulse voltage level of equipment, protective margin, establishment of separation limits, location of lightening arrestor.

Power system improvement: Introduction, methods of power system improvement, power system improvement scheme, determination of the voltage regulation and losses in a power system, shifting of distribution transformer centre, financial aspects of the power system improvement scheme.

Power system planning: Introduction, methods of power system planning, forecasting load and energy requirements, generation planning, transmission system planning, distribution system planning, reliability of electrical power systems, methods of measuring power system reliability

Text Books:

1. Electrical Power System Design – B. R. Gupta, S. CHAND
2. Electrical Power System Design – M. V. Deshpande, TMH publication

Reference Books:

1. A course in Electrical Power- Soni, Gupta and Bhatnagar, Dhanpat Rai & Sons
2. Substation Design – Satnam & Gupta, Dhanpat Rai and Co.
3. Electrical Power System Planning – A. S. Pabla, TMH publication

Course Outcomes:

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

- EEU725E.1. Identify the various aspects of the smart grid, including technologies, components, architectures and applications
- EEU725E.2. Understand the issues and challenges involved Analyze different data mining primitives for the functions.
- EEU725E.3. Study Current initiatives in the development of smart grid at national and international level implement the different algorithms of classification and prediction.
- EEU725E.4. Understand the role of communication and information technology in smart grid Implement the different algorithms for data clustering.
- EEU725E.5. Study the micro grid and interconnection issues

CO – PO – PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU725E.1	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU725E.2	2	1	2	1	0	0	0	0	0	0	0	0	2	0	0
EEU725E.3	2	1	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU725E.4	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU725E.5	2	1	2	2	0	0	0	0	0	0	0	0	2	0	0

0- Not correlated 1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU726 ENERGY MANAGEMENT

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To understand various energy management techniques.
- II. To understand energy auditing techniques.
- III. To familiarize with energy related policies.

Energy Basics: Energy Demand Management, Conservation & Resource Development, Energy for Sustainable Development.

Need for Energy Management by Sector: Industry, Buildings & Houses, Transport, Electric Power. Need for Energy Management by Sector- Agriculture, Domestic; Energy forecasting techniques; Energy Integration, Energy Matrix.

Energy Auditing: Energy management for cleaner production, application of renewable energy, appropriate technologies.

Modeling techniques for supply and demand: Market structure, transportation models, game theory, futures markets, environmental issues, energy policy, energy regulation, input/output models.

Text Books:

1. Energy Audit and Management, Volume-I, IECC Press
2. Energy Management: W.R.Murphy, G.Mckay, Butterworths Scientific

References Books

1. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience
2. Industrial Energy Management and Utilization, L.C. Witte, P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988
3. Energy Management Principles, C.B.Smith, Pergamon Press

Course Outcomes:

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

- EEU726.1. Become efficient energy managers.
- EEU726.2. Know different energy auditing methods.
- EEU726.3. Suggest energy saving methods.
- EEU726.4. Develop techniques for supply and demand.
- EEU726.5. Prepare modelling by sector.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU726.1	3	-	-	-	-	-	-	-	-	-	-	-	2	1	-
EEU726.2	3	1	2	-	-	-	-	-	-	-	-	-	2	3	-
EEU726.3	2	3	2	2	1	-	-	-	-	-	-	-	3	2	-
EEU726.4	2	3	2	2	1	-	-	-	-	-	-	-	2	2	-
EEU726.5	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU821A POWER SYSTEM DYNAMICS AND STABILITY

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To Provide In-depth understanding of different aspects of Extra High Voltage AC transmission system design and Analysis.
- II. To understand the concept of Voltage gradients of conductors.
- III. To understand the Electrostatic field and its effects over humans, animal and plants.

Basics of Power System Stability: Concept of stability, types of stability, modeling of power system components for stability studies, power system dynamics, swing equation, factors affecting stability and recent trends for improving stability

Small Disturbance Stability: Steady state stability of two-machine system, power angle curve, stability criterion, definition and computation of SSSL by analytical and graphical methods, effect of inertia, saliency, saturation, governor action and SCR on SSSL

Large Disturbance Stability: Single machine infinite bus (SMIB) system, classical model, equal area criteria technique and its applications to various types of disturbances, point by point method or solving swing equation

Excitation System: Effect of excitation system on generator power limit, various types of excitation systems, transformation model of excitation system

Text Books:

1. Power System Analysis, Hadi Sadat, Tata McGrawHill,2005
2. Modern Power System Analysis, Nagrath and Kothari, Mc Graw Hill, 2005
3. Power System stability and Control, P.Kundur, Mc GrawHill, NewYork,2007

References Books

1. Power System Stability, E.W. Kimbark, Vol 1 and3,Dover Publications 1999
2. Power System Dynamics, Stability and Control, K.R. Padiyar Interline Publishers, Bangalore,2007
3. Power System Control and Stability, P.M Anderson and A.A.Fouad, Mc Graw Hill, 2004
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

Course Outcomes:

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

- | | |
|-----------|---|
| EEU821A.1 | Interpret the basic concept of power system stability. |
| EEU821A.2 | Model the power system components for stability studies. |
| EEU821A.3 | Apply different methods for analyzing steady state stability of a two machine system. |

- EEU821A.4 Asses the transient stability using equal area criterion and Point by Point method.
- EEU821A.5 Describe the various types of excitation systems and its effect on generator power limit.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU821A.1	3	-	-	-	-	-	-	-	-	-	-	-	2	1	-
EEU821A.2	3	1	2	-	-	-	-	-	-	-	-	-	2	3	-
EEU821A.3	2	3	2	2	1	-	-	-	-	-	-	-	3	2	-
EEU821A.4	2	3	2	2	1	-	-	-	-	-	-	-	2	2	-
EEU821A.5	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU727 ELECTRICAL DRIVES AND CONTROL LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

External Total Marks: 50

Duration of ESE: 3 Hrs.

Course Objectives:

- I. Understand the concept of soft starting
- II. Test the characteristics of DC and AC drives.
- III. Explore the software's for simulation

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiment should be performed. (The laboratory may consist of 2-3 simulation studies based on Matlab-Simulink/ PSIM/ PSPICE platform and one industrial visit for study of electrical drive.)

Representative List:

1. Converter controlled dc motor.
2. Chopper controlled dc motor.
3. Stator voltage controlled induction motor.
4. Stator frequency controlled induction motor.
5. Plugging/ rheostatic braking of dc motor.
6. Plugging/rheostatic braking of induction motor.
7. Study of solid state / soft starters for electrical motors.
8. Study of electrical drive in any industry. (Industrial visit)
9. Simulation of 1/2/ 4 quadrants Converter controlled dc drive.
10. Simulation of 1/2/4 quadrant Chopper controlled dc drive
11. Simulation of open loop / closed loop V/f control of I.M.
12. Simulation of rotor chopper control of I.M.

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

COURSE OUTCOMES:

- EEU727.1. Understand the control strategies for dc/ac motor
- EEU727.2. Verify the different methods of braking for dc/ac motors
- EEU727.3. Verify the performance of dc/ac drives through simulation

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU727.1	2	1	-	-	-	-	-	-	-	-	-	-	2	2	-
EEU727.2	2	2	1	-	2	-	2	-	-	-	-	-	3	2	-
EEU727.3	2	2	1	1	2	1	-	-	-	-	-	2	3	1	-

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU821B WIND AND SOLAR SYSTEMS

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Appreciate the importance of renewable energy sources.
- II. Demonstrate the knowledge of the generation aspects of wind power and issues for grid integration.
- III. Demonstrate the knowledge of solar power generation and the associated

Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power - cumulative distribution functions, site selection and layout of wind farm.

Smart Transmission System: Phasor Measurement unit, Phasor data concentrators, Wide area measurement control and protection, Wide area measurement systems and its applications, Flexible Alternating Current Transmission Systems. High-voltage Direct-current Transmission

Network Integration Issues: Overview of grid code technical requirements for wind farms - real and reactive power regulation, voltage and frequency operating limits, wind farm behavior during grid disturbances, power system interconnection experience in the world, Economic aspects, Hybrid and isolated operations of wind farms.

The Solar Resource Introduction: solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Solar Photovoltaic Technologies: Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Maximum Power Point Tracking (MPPT) algorithms.

Solar Thermal Power Generation Technologies: Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis, prospects for India.

Text Books:

1. Renewable and Efficient Electric Power Systems, Gilbert M. Masters John Willy and sons, 2004, ISBN0-471-28060-7.
2. Solar Energy S.P. Sukhatme Tata McGraw Hill, second edition, 1996, ISBN 0-07-462453-9

Reference Books:

1. Wind Power in Power Systems, Thomas Ackermann, Editor John Willy and son's ltd., 2005, ISBN 0- 470-85508-8.
2. Grid integration of wind energy conversion systems Siegfried HeierJohn Willy and sons ltd.2006

3. Renewable Energy Applications Mullic and G.N.Tiwari Pearson Publications.

Course Outcomes:

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

- EEU821B.1. Identify and apply the data warehouse and OLAP technology for data mining.
- EEU821B.2. Understand the data preprocessing issues and data mining functions.
- EEU821B.3. Analyze different data mining primitives for the functions.
- EEU821B.4. Implement the different algorithms of classification and prediction.
- EEU821B.5. Implement the different algorithms for data clustering.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU821B.1	3	-	-	-	-	-	-	-	-	-	-	-	2	1	-
EEU821B.2	3	1	2	-	-	-	-	-	-	-	-	-	2	3	-
EEU821B.3	2	3	2	2	1	-	-	-	-	-	-	-	3	2	-
EEU821B.4	2	3	2	2	1	-	-	-	-	-	-	-	2	2	-
EEU821B.5	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU821C Electric and Hybrid Electric Vehicles

Teaching Scheme: 03 L+ 01T Total: 04

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

Students will be able to:

- I. To understand upcoming technology of hybrid system
- II. To understand different aspects of drives application
- III. Learning the electric Traction

History of Hybrid and Electric Vehicles: Social and environmental importance of hybrid and electric vehicles. Impact of modern drive/trains on energy supplies, Basics of vehicle performance, vehicle power source characterization, Transmission characteristics,

Basic Concept of Hybrid Traction: introduction to various hybrid drive-train topologies, Power flow control in hybrid drive/train topologies, Fuel efficiency analysis.

Introduction to Electric Components used in Hybrid and Electric Vehicles: Configuration and control of DC Motor drives, Configuration and control of Permanent Magnet Motor drives Configuration and control of Switch, Reluctance. Motor drives

Matching the Electric Machine and the Internal Combustion Engine (ICE): Sizing the propulsion motor, Sizing the power electronics, selecting the energy storage technology Communications, and Supporting subsystems.

Introduction to Energy Management and their Strategies used in Hybrid and Electric Vehicle: Classification of different energy management strategies, Comparison of different energy management strategies, Implementation issues of energy strategies

Text Books:

1. "Control Design Techniques in Power Electronics Devices", Sira -Ramirez, R. Silva Ortigoza Springer.
2. "Sliding mode control of switching Power Converters". Siew-Chong Tan, Yuk-Ming Lai, Chi Kong' Tse
3. "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives" Chris Mi, M. Abul Masrur, David Wenzhong Gao,, 2011, Wiley publication.

Reference Books:

1. "Hybrid Vehicles and the future of personal transportation" Allen Fuhs, 2009, CRC Press.
2. "Electric Vehicle Technology Explained" James Larminie, John Lowry,, 2003, Wiley publication.

Course Outcomes:

At the end of this course students will understand:

EEU821C.1 Concept of Electric Vehicles, Hybrid Electric Vehicles & Plug in Hybrid Electric vehicles

EEU821C.2 Concept of hybrid traction

EEU821C.3 Application of Power electronics and electric components used in hybrid and electric vehicles

EEU821C.4 Matching the electric machine and the internal combustion engine

EEU821C.5 Energy management and their strategies used in hybrid and electric vehicle

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU821C.1	2	2	1	1	2	1	1	0	0	0	0	0	1	1	1
EEU821C.2	2	2	0	2	2	0	0	0	0	0	0	0	1	2	2
EEU821C.3	2	3	0	2	2	0	0	0	0	0	0	0	1	3	2
EEU821C.4	2	3	1	2	2	1	0	0	0	0	0	0	2	2	2
EEU821C.5	2	2	0	3	2	0	0	0	0	0	0	0	0	1	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU821D CYBER SECURITY

Teaching Scheme: 03 L Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. To Define the need of Cyber Security
- II. Understand the broad set of technical, social & political aspects of Computer Security
- III. Identify the Cyber Crime Investigation Methodology.

Introduction: Nature and scope of computer crime, Understanding how cyber criminals and hackers work, Different types of cyber-crimes, Introduction to digital signatures, Cryptography, Digital certificate and public key infrastructure, IT Act., Impact of cyber-crime on e-governance and e-commerce

Malware Reverse Engineering: Overview of malware reverse engineering, Types of malware, malicious code families, Latest trends in malware analysis, Basic static and dynamic analysis, Malware analysis techniques, Case study

Web Application Security: Introduction to web application security: Attacks, vulnerabilities and mitigation, Client-side security, Server-side security, Application security: HTTPS, HSTS etc., Security engineering: Passwords and their limitations, Attacks on passwords: CAPTCHA, OTP

Advanced Security Topics: Secure Email Systems: PGP, SMIME, DKIM, DMARC, DNSSec, SMTP STS etc., Privacy and security for online social networks, Database security, Browser security, Mobile device security

Ethical Hacking and Penetration Testing: Security Technologies: IDS, IPS, Ethical hacking, Penetration testing fundamentals: Reconnaissance, scanning, gaining access, maintaining access, Covering tracks

Text Books:

1. Handbook of Information Security, Threats, Vulnerabilities, Prevention, Detection, and Management Algorithms, Hossein , Wiley, Volume 3 edition, ISBN-13: 978-0470323069.
2. Penetration testing: A Hands-On Introduction to Hacking ,Georgia Weidman No Starch Press, 2014, ISBN-13: 978-1593275648
3. Practical Malware Analysis, Michael Sikorski and Andrew Honig, No Starch Press, 1st Edition, 2012, ISBN-13: 978-1593272906

Reference Books:

1. Practical Internet of Things Security by Brian Russell, Drew Van Duren, Packet publishing, 2016, ISBN: 9781785889639

2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, T. Mather, S. Kumaraswamy, S. Latif, O'Reilly Series, 2009, ISBN-13: 978-0596802769.
3. Cyber law: the Indian perspective, Pavan Duggal; Saakshar Law Publications, 1st edition, 2002, ISBN: 8189121022, 9788189121020.

Course Outcomes:

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

- EEU821D.1. Demonstrate the knowledge of penetration testing, and social networking security.
- EEU821D.2. Analyze the malwares, social networking websites and impact of cyber-crime on ecommerce
- EEU821D.3. Explain the IT act, Application Security vulnerabilities and its mitigation techniques
- EEU821D.4. Describe the operational and organizational security Aspects
- EEU821D.5. Explain Authentication Methods

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU821D.1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0
EEU821D.2	1	1	2	0	2	0	0	0	0	0	0	0	0	2	0
EEU821D.3	1	1	2	2	0	0	0	0	0	0	0	0	0	2	0
EEU821D.4	1	2	2	2	1	0	0	0	0	0	0	0	0	0	1
EEU821D.5	1	3	0	0	2	0	0	0	0	0	0	0	1	0	0

0- Not correlated 1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU821E ADVANCED DRIVES

Teaching Scheme: 03 L + 00 T Total 03

Credit: 03

Marking Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Course Objectives:

- I. To impart knowledge about fundamentals of Electric drives and control
- II. To acquire the knowledge of selection of drives as per practical operational industrial requirement.
- III. To apply their knowledge to prepare control schemes as per different types of motors used in industries.

Review of Electric Drives: Classification, Comparison of AC and DC drives, Basic elements, Torque equation, Multi-quadrant operation, Equivalent values of drive parameters, components of load torque, Stability consideration, closed loop control of drives, Thermal model of motor for Heating and Cooling, Classes of Duty.

DC Drives: Half controlled, full controlled and dual converter based separately excited dc motor drives and their analysis. Effect of source and load inductance. DC-DC converter (Chopper) fed dc series motor drives and its steady state analysis.

Induction Motor Drives: Review of induction motor equivalent circuit, Effect of voltage, frequency and stator current on performance of the machine, effect of harmonics, harmonic equivalent circuit, dynamic d-q model, derivations of commonly used induction motor models, scalar control of induction motor.

Synchronous Motor Drives: Review of synchronous motor fundamentals, equivalent circuit, Dynamic d-q model, and Synchronous motors variable speed drives.

Special Drives: Brushless / Commutator less dc motor drives: Configuration, modes of operation and analysis. Switched Reluctance motor drives: Configuration, converters, modes of operation and analysis.

Special Topics: Measures of energy conservation in electrical drives. Introduction to the fundamental principles of torque controlled and sensor less drives, Vector controlled and direct torque controlled induction motor drives.

Text Books:

1. Fundamentals of Electrical Drives by G. K. Dubey Narosa Publishing House, 1995.
2. Electric Motor Drives: Modeling, Analysis and Control R. Krishnan Pearson Edu.,1998
3. Modern Power Electronics and AC Drives by B.K.Bose Pearson Education, Asia, 2003
4. Power Electronics and Variable Frequency Drives by B.K.Bose Standard Pub, 2000.

Reference Books:

1. Thyristor DC Drives by P.C.Sen John Wiley & Sons, 1981.
2. Power Electronic Control of AC Motors by JMD Murphy & FG Turnbull Pergamon Press,1988.
3. Power Semiconductor Controlled Drives by G.K. Dubey PH Int., 1989

4. Electric Drives-Concepts and Applications by V.Subrahmanyam, TMH, 1994.
5. Sensor less Vector and Direct Torque Control P. Vas Oxford Press, 1998.
6. Analysis of Thyristor Power Conditioned Motors by S.K.Pilley University Press, 1992.
7. <http://www.nptel.iitm.ac.in/>
8. www.ocw.mit.edu

Course Outcomes:

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

- EEU821.E.1. Analyze and simulate basic models of dc and ac drives.
- EEU821.E.2. Derive required characteristics from motor with the help of suitable controller.
- EEU821.E.3. Justify the applications of BLDC, SRM and sensor-less drives.
- EEU821.E.4. Understand the principles of vector controlled and direct torque controlled induction motor drives.
- EEU821.E.5. Emphasize the measures of energy conservation in electrical drives.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU821E.1	2	2	0	0	3	0	0	0	0	0	0	0	2	0	0
EEU821E.2	2	0	1	0	1	0	0	0	0	0	0	0	1	0	0
EEU821E.3	2	0	1	1	0	2	0	0	0	0	0	2	1	2	0
EEU821E.4	2	2	0	1	2	0	0	0	0	0	0	1	1	0	0
EEU821E.5	0	0	0	0	1	2	2	1	0	0	0	1	2	2	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU822 PROJECT AND SEMINAR/ INDUSTRY INTERNSHIP PROJECT
Teaching Scheme : 03 P Total: 03 Credit: 14
Evaluation Scheme: 200 ICA + 200 ESE Total Marks: 400
Duration of ESE: 3 Hrs.

Course Objectives:

- I. To develop skills in doing literature survey, technical presentation and report preparation
 - II. To Perceive the idea and decide the objectives of project from literature survey
 - III. To enable project identification and execution of preliminary works on project
-
1. Student shall select and deliver a topic for seminar which is **not covered in curriculum**
 2. In general, a group of 3-6 students should be allowed to complete the project on Approved topic.
 3. Preferably more than 25 % projects shall be Industry / Research based / oriented.
 4. Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.
 5. Students should finalize the topic for the project after literature survey in consultation with the Guide.
 6. The **Synopsis/Abstract** on the selected topic should be submitted to the H.O.D. for approval.
 7. On approval of the topic, students should initiate the topic based work.
 8. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
 9. Students shall submit the final project report in proper format as per guide lines given on the college website which shall include the work of both semesters.
 10. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
 11. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

INDUSTRY INTERNSHIP PROJECT

- I. The aim of Industry Internship Project is to closely work with industry to apply theoretical knowledge in a real-world context providing real industrial project enabling learning focused on the application knowledge. This gives a student an opportunity to make their first traces in the industrial reality and start building a personal network, an important prerequisite for a successful industry career.

- II. The purpose of the INDUSTRY INTERSHIP PROJECT to solve real industrial problems by following established engineering methods, working in teams, and effectively communicating with various stakeholders.
- III. The students can work in group decided by the department as per availability of Faculty. The individual students can also undertake the Industry Institute Project subject to availability of Industry Mentor/Guide. Students/Group selects the industry which is ready to provide INDUSTRY INTERSHIP PROJECT through oral/written communication. Once selected the student group has to visit the industry/stay as per need. The institute will not provide any assistance in Travel and Stay. The student/ Group need to submit acceptance letter from Industry regarding allowing the student/groups for INDUSTRY INTERSHIP PROJECT stating the Project name or research area.
- IV. Each group has an Industry Project Guide and Institute Project Guide. The meeting with Project guide is once within week/two week at Institute. These meetings typically include assistance in finding solutions recent problems in the projects, technical support on applied software packages, and support with writing the final report. The project groups do multiple company visits where they meet the industrial contacts to formulate the problem, collect data and information, and gain necessary experiences from the industry.
- V. Furthermore, INDUSTRY INTERSHIP PROJECT includes seminars aiming to give the students experience of communicating to a larger audience, working in teams, etc. The Project monitoring will be done by Institute Guide to know whether learning objective is achieved or not.
- VI. The INDUSTRY INTERSHIP PROJECT undergone individual student/ Group will have to submit following documents on the successful completion of Industry Institute Project
 1. Authenticated attendance record from Industry internship project mentor/supervisor/Guide
 2. Industry internship project signed by Industry Mentor/Guide
 3. Industry internship project Completion Letter by Industry Mentor/ Guide
 4. Project evaluation report signed by Industry Mentor/ Guide

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge/skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head.

ESE: The End Semester Examination for Project shall consist of Demonstration if any, presentation and oral examinations based on the project report.

Course Outcomes:

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

- EEU822.1. Perceive the idea and decide the objectives of project from literature survey
- EEU822.2. Integrate information from multiple sources.
- EEU822.3. Identify, analyze, and solve problems creatively through sustained critical investigation.
- EEU822.4. Implement the idea with effective leadership in prescribed schedule
- EEU822.5. Prepare the effective technical document related to work carried out

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU822.1	3	1	3	0	0	0	0	0	3	0	2	0	3	2	1
EEU822.2	2	3	2	3	0	0	0	0	2	0	3	0	1	3	0
EEU822.3	2	2	3	2	0	0	0	0	2	0	2	0	2	2	2
EEU822.4	2	2	3	2	0	0	0	0	2	0	2	0	2	3	3
EEU822.5	2	2	3	0	0	0	0	0	2	0	3	0	1	2	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Annexure –C

Equivalence Scheme -I

(VI & VIII Sem)

S. N.	Course in new scheme (164)			Equivalent course in old Scheme (184)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	EEU721	Electrical Drives and Control	3	EEU802	Electrical Drives and control	3
2	EEU722A	A) EHV AC Transmission	3	EEU804B	High voltage Transmission	3
3	EEU722B	B) High Voltage Engineering	3	EEU803B	HV High Voltage Engineering	3
4	EEU722C	C) AI and Machine Learning	3		No Equivalence	--
5	EEU722D	D) Data Structures	3			
6	EEU722E	E) Energy Storage System	3			
7	EEU723A	A) Power System Modelling	3		No Equivalence	--
8	EEU723B	B) Smart Grid	3			
9	EEU723C	C) Advanced Microprocessors	3	EEU703B	Advanced Microprocessors	3
10	EEU723D	D) Algorithms	3		No Equivalence	--
11	EEU723E	E) Power System Transients	3			
12	EEU724A	Fundamental of Electrical Drives	3		No Equivalence	--
13	EEU724B	Electrical Estimating and Costing	3		No Equivalence	--
14	EEU725A	A) HVDC and FACTS	3	EEU804A	HVDC and FACTS	3
15	EEU725B	B) Power Quality Issues and Mitigation	3	EEU804C	Power Quality & Deregulation	3
16	EEU725C	C) Digital Control System	3		No Equivalence	--
17	EEU725D	D) Computer Network	3		No Equivalence	--
18	EEU725E	E) Power System planning and Design	3		No Equivalence	--
19	EEU727	Energy Management	3		No Equivalence	--
20	EEU725	Electrical Drives and Control Lab	2	EEU806	Electrical Drives and Control Lab	2
21	EEU821A	A) Power System Dynamics and Stability	3	EEU801	Power System Stability	3
22	EEU821B	B) Wind and Solar Systems	3		No Equivalence	--
23	EEU821C	C) Electrical and Hybrid Vehicles	3		No Equivalence	--
24	EEU821D	D) Cyber Security	3		No Equivalence	--
25	EEU821E	Advanced Drives	3		No Equivalence	--
26	EEU822	C. Project and Seminar OR D. Industry Internship Project	26		No Equivalence	--

Equivalence Scheme -II

S. N.	Course in old Scheme (184)			Equivalent Course in new scheme (164)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	EEU701	Switch Gear and Protection	3	EEU624A	Power system Protection	3
2	EEU702	Linear & Digital Integrated Circuits	3		No Equivalence	--
3	EEU703 A	A) Digital Signal Processing	3		No Equivalence	3
4	EEU703 B	B) Advanced Microprocessor	3	EEU723C	C) Advanced Microprocessors	3
5	EEU703 C	C) Computer Methods in Power System Analysis	3		No Equivalence	--
6	EEU703 D	D) Power System Operation and Control	1	EEU621	Power Systems –Operation and Control	3
7	EEU704 A	A) Electromechanical Energy Conversion	1		No Equivalence	--
8	EEU704 B	B) Robotics and Automation	1		No Equivalence	--
9	EEU705	Switch Gear and Protection Lab	1		No Equivalence	--
10	EEU706	Linear & Digital Integrated Circuits Lab	1		No Equivalence	--
11	EEU707 A	A) Digital Signal Processing lab	1		No Equivalence	--
12	EEU707 B	B) Advanced Microprocessor lab	1		No Equivalence	--
13	EEU707 C	C) Computer Methods in Power System Analysis lab	1		No Equivalence	--
14	EEU707 D	D) Power System Operation and Control lab	1		No Equivalence	--
15	EEU708	Project Phase - I	2		No Equivalence	--
16	EEU709	Seminar	2		No Equivalence	--
17	EEU710	Industrial Training /Visit	1		No Equivalence	--
18	EEU711	Industrial Lecture - II*	1		No Equivalence	--
19	EEU712	Self Study - III	2		No Equivalence	--
20	EEU801	Power Systems Stability	3	EEU821A	D) Power System Dynamics and Stability	3
21	EEU802	Electrical Drives and Control	3	EEU721	Electrical Drives and Control	3
22	EEU803 A	A) Multirate DSP and Wavelet	3	No Equivalence		
23	EEU803 B	B) High Voltage Engineering	3	EEU722B	High Voltage Engineering	3
24	EEU803 C	C) Network Synthesis	3	No Equivalence		--
25	EEU803 D	D) Artificial Neural Network	3	No Equivalence		--
26	EEU804A	A) HVDC and FACTS	3	EEU725A	HVDC and FACTS	

						3
27	EEU804B	B) High Voltage Transmission	3	EEU722A	EHV AC Transmission	3
28	EEU804 C	C) Power Quality & Deregulation	3	EEU725B	Power Quality Issues and Mitigation	3
29	EEU804D	D) Statistical Signal Processing	3	No Equivalence		--
30	EEU805	Power Systems Dynamics Lab	1	No Equivalence		--
31	EEU806	Electrical Drives and Control Lab	1	No Equivalence		--
32	EEU807A	A) Multirate DSP and Wavelet lab	1	No Equivalence		--
33	EEU807B	B) High Voltage Engineering lab	1	No Equivalence		--
34	EEU807 C	C) Network Synthesis lab	1	No Equivalence		--
35	EEU807D	D) Artificial Neural Network lab	1	No Equivalence		--
36	EEU808	Project Phase - II	6	No Equivalence		--
37	EEU809	Self study - IV	2	No Equivalence		--

Equivalence Scheme -I (V & VI Sem)

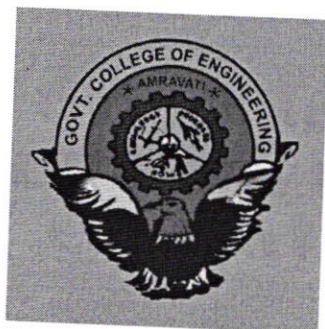
S. N.	Course in new scheme (164)			Equivalent course in old Scheme (184)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	EEU521	Power Electronics	3	EEU601	Power Electronics	3
2	EEU522	Power Systems – Apparatus and Modelling	4	EEU502	Power System Analysis- I	3
3	EEU523	Control System	3	EEU503	Control System - I	3
4	EEU524	Microprocessor and Microcontrollers	3	EEU504	Introduction to Microprocessor and Microcontrollers	3
5	EEU525	Industrial Organization & Management	3	EEU505	Industrial Organization & Management	3
6	EEU526A	Electrical Machine Design	3	EEU604	Electrical Machine Design	3
7	EEU526B	Industrial Electrical Systems	3	No equivalence		
8	EEU526C	Digital Signal Processing	3			
9	EEU526D	Computer organisation	3			
10	EEU526E	Embedded Systems	3			
11	EEU527	Power Electronics Lab	1	EEU606	Power Electronics Lab	1
12	EEU528	Power Systems – Apparatus and Modelling Lab	1	EEU507	Power System Analysis - I Lab	1
13	EEU529	Control Systems Lab	1	EEU508	Control System - I Lab	1
14	EEU530	Microprocessor and Microcontrollers Lab	1	EEU509	Introduction to Microprocessor and Microcontrollers Lab	1
15	EEU621	Power Systems –Operation and Control	3	EEU602	Power System Analysis - II	3
16	EEU622	Control System Design	4		No equivalence	
17	EEU623	Operation Research Techniques	4	EEU605	Operation Research Techniques	3
18	EEU624A	Power system Protection	3	EEU701	Switch Gear and Protection	3
19	EEU624B	Energy Conservation in Electrical Utilities	3	No equivalence		
20	EEU624C	Object Oriented Programming	3			
21	EEU624D	Internet of Things	3			
22	EEU625A	Electromechanical Energy Conversion	3	EEU704A	Electromechanical Energy Conversion	3
23	EEU625B	Energy Efficiency in Electrical Utilities	3	EEU704C	Energy Efficiency in Electrical Utilities	3
24	ETU631	Electronics Design Lab	3	No equivalence		
25	EEU626	Power Systems –Operation and Control Lab	1	EEU607	Power System Analysis - II Lab	1
26	EEU627	Control System Design Lab	1	No equivalence		
27	EEU628	Minor Project	2	EEU610	Minor Project	2

Equivalence Scheme -II

S. N.	Course in old Scheme (184)			Equivalent Course in new scheme (164)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	EEU501	Electrical Machines II	3	EEU421	AC Machines	3
2	EEU502	Power System Analysis- I	3	EEU522	Power Systems – Apparatus and Modelling	4
3	EEU503	Control System - I	3	EEU523	Control System	3
4	EEU504	Introduction to Microprocessor and Microcontrollers	3	EEU524	Microprocessor and Microcontrollers	3
5	EEU505	Industrial Organization & Management	3	EEU525	Industrial Organization & Management	3
6	EEU506	Electrical Machines II Lab	1	EEU425	Electrical Machines Lab II	1
7	EEU507	Power System Analysis - I Lab	1	EEU528	Power Systems – Apparatus and Modelling Lab	1
8	EEU508	Control System - I Lab	1	EEU529	Control Systems Lab	1
9	EEU509	Introduction to Microprocessor and Microcontrollers Lab	1	EEU530	Microprocessor and Microcontrollers Lab	1
10	EEU510	Computational Lab-II	2		No equivalence	
11	EEU511	Self study I	2		No equivalence	
12	EEU601	Power Electronics	3	EEU521	Power Electronics	3
13	EEU602	Power System Analysis - II	3	EEU621	Power Systems –Operation and Control	3
14	EEU603	Control System -II	3		No equivalence	
15	EEU604	Electrical Machine Design	3	EEU526A	Electrical Machine Design	3
16	EEU605	Operation Research Techniques	3	EEU623	Operation Research Techniques	4
17	EEU606	Power Electronics Lab	1	EEU527	Power Electronics Lab	1
18	EEU607	Power System Analysis - II Lab	1	EEU626	Power Systems –Operation and Control Lab	1
19	EEU608	Control System –II Lab			No equivalence	
20	EEU609	Electrical Machine Design Lab			No equivalence	
21	EEU610	Minor Project	2	EEU628	Minor Project	2
22	EEU611	Self Study-II			No equivalence	
23	EEU612	Industrial Lecturer -I	-		No equivalence	

**GOVT. COLLEGE OF ENGINEERING,
AMRAVATI**

DEPARTMENT OF ELECTRICAL ENGINEERING



CURRICULUM

For

Third Year B. TECH. (Electrical Engineering)

2021- 2022

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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. Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.



Semester I

Teaching Scheme							Evaluation Scheme						Credits
Category	Course Code	Course Title	Theory	Tutorial	Practical		Theory			Practical		Total	
			Hrs/week	Hrs/week	Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
MC	SHU100	Induction Program	Two weeks mandatory audit course										0
BSC	SHU121	Physics	3	1	---	4	30	10	60	---	---	100	4
BSC	SHU122	Calculus and Linear Algebra	3	1	---	4	30	10	60	---	---	100	4
ESC	EEU121	Basic Electrical Engineering	3	---	---	3	30	10	60	---	---	100	3
ESC	CEU121	Engineering Mechanics	3	---	---	3	30	10	60	---	---	100	3
HSMC	SHU123	English	2	---	---	2	---	---	60	---	---	60	2
BSC/LC	SHU124	Physics Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	EEU122	Basic Electrical Engg Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CEU122	Engineering Mechanics Lab	---	---	2	2	---	---	---	50	---	50	1
HSMC/LC	SHU125	English Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	MEU121	Workshop Practice I	---	---	2	2	---	---	---	50	---	50	1
		Total	14	2	10	26	120	40	300	250	0	710	21

Semester II

Teaching Scheme							Evaluation Scheme						Credits
Category	Course Code	Course Title	Theory	Tutorial	Practical		Theory			Practical		Total	
			Hrs/week	Hrs/week	Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
BSC	SHU221	Chemistry	4	---	---	4	30	10	60	---	---	100	4
BSC	SHU222	Integral calculus and differential equations	3	1	---	4	30	10	60	---	---	100	4
ESC	CSU221	Programming for Problem solving	3	---	---	3	30	10	60	---	---	100	3
ESC	MEU221	Engineering Graphics	2	---	---	2	30	10	60	---	---	100	2
ESC	MEU222/ ETU221	Basic Mechanical Engineering/ Basic Electronics Engineering	2	---	---	2	30	10	60	---	---	100	2
BSC/LC	SHU223	Chemistry Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CSU222	Programming for Problem solving Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU223	Engineering Graphics Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU224	Workshop Practice II	---	---	2	2	---	---	---	50	---	50	1
		Total	14	1	12	27	150	50	300	200	0	700	21

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment
MSE Duration: 1.30 Hrs all courses

Important Note:

MEU222 for only Electrical, Electronics & TC, Computer Science, Information Technology and Instrumentation Engineering branch

ETU221 for only Civil and Mechanical Engineering branch

In Semester I, the students of Civil, Mechanical, Electrical & Instrumentation Engineering shall be offered group A courses, and that of Electronics & TC, Computer Science and Information Technology shall be offered group B courses. In Semester II, vice versa.

In addition following courses are offered

SHU122 and MEU121 for all students in Semester I. SHU222 and MEU224 for all students in Semester II.

MEU222 shall be offered in Semester I for Electronics & TC, Computer Science, Information Technology branch. And it shall be offered in Semester II for Electrical and Instrumentation Engineering branch

ETU221 shall be offered in Semester II for Civil and Mechanical Engineering branch.

There should be direct correspondence of group A and group B courses.

Sr. No.	Group A Courses		Group B Courses	
	Course Code	Title of Course	Course Code	Title of Course
1	SHU121	Physics	SHU221	Chemistry
2	EEU121	Basic Electrical Engineering	CSU221	Programming for Problem solving
3	CEU121	Engineering Mechanics	MEU221	Engineering Graphics
4	SHU123	English	SHU223	Chemistry Lab
5	SHU124	Physics Lab	CSU222	Programming for Problem solving Lab
6	EEU122	Basic Electrical Engineering Lab	MEU223	Engineering Graphics Lab
7	CEU122	Engineering Mechanics Lab		
8	SHU125	English Lab		
Category of Course		Definition	Credits	
BSC		Basic Science Courses	18	
ESC		Engineering Science Courses	21	
HSMC		Humanities and Social Sciences including Mgt.Courses	3	
			Total Credits	42

B. Tech. (Electrical Engineering)

B. Tech. (Electrical Engineering)													
Category	Course Code	Name of the Course	SEM III				Evaluation Scheme						Credits
			Teaching Scheme				Theory			Practical	Total		
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
HSMC	SHU321C	Transform and Statistical methods	3	1	---	4	30	10	60	-	-	100	4
	*SHU322C	Integral Calculus and Probability											
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	SHU323	Introduction to Constitution of India	1	---	---	0	---	20	30	---	---	50	0
LC	ETU332C	Analog Electronic Circuits 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
Second year admitted students													

* For Direct second year admitted students

B. Tech. (Electrical Engineering)

B. Tech. (Electrical Engineering)													
Category	Course Code	Name of the Course	SEM IV Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		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	1	---	---	1	---	20	30	---	---	50	0
	Total		17	1	6	24	120	80	300	150	---	650	19

B. Tech. (Electrical Engineering)

SEM V													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs./week	Tutorial Hrs./week	Practical Hrs./week	Total	Theory			Practical		Total	
							MSE	TA	ESE	ICA	ES E		
PCC	EEU521	Power Electronics	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU522	Power Systems – Apparatus and Modelling	3	1	---	4	30	10	60	-	-	100	4
PCC	EEU523	Control System	3	---	---	3	30	10	60	-	-	100	3
PCC	EEU524	Microprocessor and Microcontrollers	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	1	8	27	180	60	360	150	50	800	23

B. Tech. (Electrical Engineering)

B. Tech. (Electrical Engineering)													
SEM VI													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs. /week	Tutorial Hrs./week	Practical Hrs./week	Total	Theory			Practical		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

B. Tech. (Electrical Engineering)

B. Tech. (Electrical Engineering)													
Category	Course Code	Name of the Course	SEM VII Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		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	EEU726	Program Elective - V	3	--	--	3	30	10	60	-	-	100	3
SHMC	EEU727	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)

B. Tech. (Electrical Engineering)													
Category	Course Code	Name of the Course	SEM VIII Teaching Scheme				Evaluation Scheme						Credits
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		Total	
							MSE	TA	ESE	ICA	ESE		
PEC	EEU821	Program Elective - VI	3	--	--	3	30	10	60	-	-	100	3
PROJ	EEU822	A. Project and Seminar OR	--	--	26	26	-	-	-	200	200	400	14
		B. Industry Internship Project											
	Total		3	0	26	29	30	10	60	200	100	500	17

Program Elective Courses

PE-I	PE-II	PE-III	PE-IV	PE-V	PE-VI
A) Electrical Machine Design	A) Power system 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) 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) Embedded Systems	E) Internet of Things	E) Energy Storage System	E) Power System Transients	E) Power System Design	Advanced Drives

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



EEU521 POWERELECTRONICS

Teaching Scheme: 03 L+ 00T Total: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE: 2hrs.30min

Credits: 03

Total Marks: 100

Course Objectives:

- I. Role of Power Electronics in control and conversion of Electrical power
- II. Analysis of all power converters
- III. PWM converters, Switched mode converters and UPS system.

Thyristor family devices: Structure, Characteristics, Switching actions, Trigger requirements, Ratings, Protections and applications of SCR, TRIAC and DIAC.

Modern Power Devices: Structure, Characteristics, Switching actions, Trigger requirements, Protections and Applications of GTO, IGBT, Power MOSFET and MCT. Introduction to Power Integrated Circuits and Silicon Carbide (SiC) Power Devices

AC-DC and AC/DC Converters (Controlled Rectifiers): Single phase half controlled (semi-converter) and fully controlled converters - Quadrants of operation, circuit configurations, working, performance parameters and input-output wave forms for R and R-L loads, continuous and discontinuous current conduction, effect of freewheeling diode. Single phase dual converter in circulating and non-circulating current modes.

DC-DC Converters (DC Choppers): Step-up and step-down configurations, CLC and TRC techniques, PWM and FM techniques. Practical thyristorized and transistorized chopper circuit- working, control, commutation, waveforms, continuous and discontinuous current conduction.

DC-AC Converters (Inverters): VSI and CSI. PWM techniques-Single, Multiple and Sinusoidal PWM. Transistorized(PWM) Inverters-Principle of operation, performance parameters and working of single phase and three phase circuits.

PWM PWM Converters: Principle of operation, circuit configurations and applications of Switched Mode Converters (buck, boost and buck-boost) and Switched Mode Rectifiers. Principle of cyclo converter, single phase to single phase cyclo converter circuit. Single phase AC regulators with R and R-L loads, Power factor corrector circuits, Introduction to UPS systems.

Text Books:

1. Power Electronics-Circuits Devices and Application, M. H. Rashid 2nd Ed, Prentice Hall of India (PHI) Pvt. Ltd., New Delhi, 2003.
2. Power Electronics – Converters, Applications and Design, Mohan, Undeland, Robbins, 3rd Ed, John Wiley & Sons, 2004



Reference Books:

1. SCR Manual, General Electric, 6th Ed, 1990.
2. Modern Power Devices, B. J. Baliga, John Wiley, 1992.
3. Power Electronics Principles and Applications, Joseph Vithayathil, Tata McGraw-Hill Edition, 2010
4. Power Electronics–Devices, Drivers and Applications, B. W. Williams, John Wiley, 2005
5. Power Electronics, K Thorborg, PHI Int. Ltd, 1988.
6. <http://www.nptel.iitm.ac.in>
7. www.ocw.mit.edu

Course Outcomes:

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

- EEU521.1 Classify different types of Power Semiconductor Switches.
- EEU521.2 Evaluate V-I characteristics, turn-on and turn-off methods for different power semiconductor devices.
- EEU521.3 Compare different types of Power Converters with their operational and analytical details.
- EEU521.4 Analyse waveforms at the input and output ports of the converters.
- EEU521.5 Understand construction and working of PWM converters, UPS, Power factor corrector circuit etc.

CO – PO – PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU522.1	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0
EEU522.2	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0
EEU522.3	3	3	2	2	2	0	0	0	0	0	0	0	2	2	0
EEU522.4	2	3	0	1	2	0	0	0	0	0	0	0	2	2	0
EEU522.5	2	1	0	0	0	0	0	0	0	0	0	0	1	1	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU522 POWER SYSTEM– APPARATUS AND MODELLING

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Understand the concepts of power system & various power system components.
- II. Analyse different faults in power system.
- III. Explain the generation of over-voltages and insulation coordination.

Basic Concepts: Evolution of power systems and present-day scenario. Structure of a power system: Bulk power grids and micro-grids.

Generation: Conventional and renewable energy sources. Distributed energy resources. Energy storage. Transmission and distribution systems: line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) inter connections. Review of three-phase systems. Analysis of simple three-phase circuits. Power transfer in AC circuits and reactive power.

Power System Components: Overhead transmission lines and cables: Electrical and magnetic fields around conductors, Corona. Parameters of lines and cables. Capacitance and inductance calculations for simple configurations. Travelling-wave equations, Sinusoidal steady state representation of lines: short, medium and long lines. Power transfer, voltage profile and reactive power. Characteristics of transmission lines. Surge impedance loading, series and shunt compensation of transmission lines.

Transformers: Three-phase connections and phase-shifts. three-winding transformers, autotransformers, neutral grounding transformers. Tap-changing in transformers. Transformer parameters. Single phase equivalent of three-phase transformers.

Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and reactive power capability curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits. Loads: Types, Voltage and frequency dependence of Loads. Per-unit System and per-unit calculations.

Over-voltages and Insulation Requirements: Generation of over-voltages: Lightning and switching surges. Protection against over voltages, insulation coordination. Propagation of surges. Voltages produced by traveling surges. Bewley diagrams.

Fault Analysis and Protection Systems: Method of symmetrical components (positive, negative and zero sequences). Balanced and unbalanced faults. Representation of generators, lines and transformers in sequence networks. Computation of fault currents, Neutral grounding.



Text Books:

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", Mc-Graw Hill Education, 2003
2. Hadi Sadata Power System Analysis, Mc-Graw Hill. US, 2008

Reference Books:

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

Course Outcomes:

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

- EEU522.1 Classify different types of Power Semiconductor Switches.
- EEU522.2 Evaluate V-I characteristics, turn-on and turn-off methods for different power semiconductor devices.
- EEU522.3 Compare different types of Power Converters with their operational and analytical details.
- EEU522.4 Analyze waveforms at the input and output ports of the converters.
- EEU522.5 Understand construction and working of PWM converters, UPS, Power factor corrector circuit etc.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU522.1	2	2	0	1	2	0	0	0	0	0	0	0	1	1	1
EEU522.2	2	1	0	2	2	0	0	0	0	0	0	0	1	2	2
EEU522.3	1	3	0	2	2	0	0	0	0	0	0	0	1	3	2
EEU522.4	1	3	0	2	2	0	0	0	0	0	0	0	2	2	2
EEU522.5	1	1	0	3	2	0	0	0	0	0	0	0	0	1	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU523 CONTROL SYSTEM

Teaching Scheme: 03 L+ 01T Total: 04

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE: 2hrs.30min

Credits: 04

Total Marks: 100

Course Objectives:

- I. Role of control system in modernization
- II. Analyse the control system in time domain, frequency domain and in state space
- III. Investigate the stability of control systems.

Introduction to control problem: Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

Time Response Analysis: Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Frequency-response analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

State variable Analysis: Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Introduction to Optimal Control and Nonlinear Control: Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis.

Text Books:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995

Reference Books:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009



Course Outcomes:

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

EEU523.1 Formulate mathematical model of LTI systems using TF and state space representation.

EEU523.2 Explore control systems in time domain and frequency domain.

EEU523.3 Understand the concept of stability and assessment for LTI systems.

EEU523.4 Represent the linear discrete-time systems by State-space models.

EEU523.5 Design simple feedback controllers.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU523.1	3	1	1	3	0	0	0	0	0	0	0	0	1	3	0
EEU523.2	3	3	3	2	2	0	0	0	0	0	0	0	2	3	0
EEU523.3	3	3	3	2	2	0	0	0	0	0	0	0	2	3	0
EEU523.4	3	3	1	3	3	0	0	0	0	0	0	0	0	2	0
EEU523.5	3	3	2	3	1	0	0	0	0	0	0	0	0	3	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU524 MICROPROCESSOR AND MICROCONTROLLERS

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Imparting the knowledge about the complete hardware of the microprocessor and microcontrollers
- II. Imparting the knowledge of the software used to develop programs
- III. Skills to interface a variety of external devices with microcontrollers

Fundamentals of Microprocessors: Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

The 8051 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Instruction Set and Programming: Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Memory and I/O Interfacing: Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.

External Communication Interface and applications: Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

Text Books:

1. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007.
2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.



3. R. S. Gaonkar, “, Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 1996

Reference Books:

1. R. Kamal, “Embedded System”, McGraw Hill Education, 2009.
2. D.A. Patterson and J.H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013
3. D. V. Hall, “Microprocessors & Interfacing”, McGraw Hill Higher Education, 1991

Course Outcomes:

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

EEU524.1 Formulate mathematical model of LTI systems using TF and state space representation

EEU524.2 Explore control systems in time domain and frequency domain

EEU524.3 Understand the concept of stability and assessment for LTI systems

EEU524.4 Represent the linear discrete-time systems by State-space models

EEU524.5 Design simple feedback controllers.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU524.1	2	1	0	0	0	0	0	0	0	0	0	0	1	2	1
EEU524.2	1	1	2	2	1	0	0	0	0	0	0	0	1	2	1
EEU524.3	0	1	1	2	2	0	0	0	0	0	0	1	1	1	1
EEU524.4	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1
EEU524.5	0	0	0	2	2	0	0	0	0	0	0	1	2	1	2

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU525 INDUSTRIAL ORGANIZATION & MANAGEMENT

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Understand principles of management, marketing and financial management
- II. Know Personnel Management
- III. Learn estimating and costing

Introduction: Definition and Concept, principles of management, management and administration, functions of management, various areas of management, ownership and types of ownerships, concept of organization structure-types and relationship, centralization, decentralization, delegation of power, span of working.

Marketing Management: Concept, different types of market research, various marketing strategies, types of markets, market segmentation, sales organization structure and responsibilities, advertising media, sales performance objectives, services marketing, Introduction to International marketing decisions, practices and problems of international marketing, import export procedures.

Financial Management: Need for finance, elements of cost, waste and scrap, financial ratios, profit and loss statements, balance sheet, working and fixed capital, different methods of depreciation.

Personnel Management: Functions of Personnel Management, human resources planning, recruitment and training, workers participation in management, collective bargaining, job evaluation and performance appraisal, industrial disputes, industrial safety, labor legislation.

Estimating, Costing and Materials Management: Objectives of estimating and costing, elements of cost, estimating procedure for weights, material costs, machining time, fabrication cost. Classes of materials, purchasing methods and procedure, inventory control, stores, EOQ, ABC analysis.

Text Books:

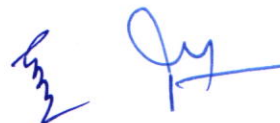
1. Essentials of Management, Koontz, Harold, McGraw-Hill Education (India) I, New Delhi, 2004.
2. Industrial Engineering and Management, O.P.Khanna, Dhanpa tRai & Sons, 1998.

Reference Books:

1. Inventory Management Chandra Bose, PHI, New Dehli 2005.
2. Industrial Engineering and Management Science, Banga, T.R., Khanna Publishers 1989.
3. Purchasing and Materials Management, Gopalkrishnan, McGraw-Hill Education (India) I, New Delhi, 2001.

Course Outcomes:

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



- EEU525.1 Know principles of management.
 EEU525.2 Understand marketing management and financial management
 EEU525.3 Understand Personnel Management
 EEU525.4 Capable to do estimating and costing of material
 EEU525.5 Study of material management

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU525.1	0	0	0	0	0	1	2	2	2	2	0	1	0	1	2
EEU525.2	0	0	0	0	0	1	0	0	3	3	2	1	0	1	2
EEU525.3	0	0	0	0	0	1	1	2	1	2	-	1	0	1	2
EEU525.4	0	0	0	0	0	0	0	0	1	0	2	1	0	0	1
EEU525.5	0	0	0	0	0	0	1	0	1	0	2	1	0	1	1

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU526(A) ELECTRICAL MACHINE DESIGN

Teaching Scheme: 03 L+ 00T Total: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE: 2hrs.30min

Credits: 03

Total Marks: 100

Course Objectives:

- I. Challenges in efficient and cost-effective electrical machine design
- II. Design procedures for various electrical machines
- III. Computer aided design approach for optimal electrical machine design.

Introduction: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines

Transformers: Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

Induction Motors: Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

Synchronous Machines: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design

Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Text Books:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.

Reference Books:

1. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
2. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.
3. Shanmuga sundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.



4. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
5. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

Course Outcomes:

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

- EEU526A.1 Understand the construction and performance characteristics of electrical machines.
- EEU526A.2 Analyze the effect of various factors which influence the design, electrical, magnetic and thermal loading of electrical machines
- EEU526A.3 Apply the principles of electrical machine design and carry out a basic design of electrical machines.
- EEU526A.4 Comprehend various approaches for computer aided design of electrical machines.
- EEU526A.5 Use software tools to do design calculations.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU526A.1	3	2	3	0	0	0	0	0	0	0	0	0	3	2	0
EEU526A.2	3	3	3	2	2	0	1	0	0	0	0	0	3	0	0
EEU526A.3	3	3	3	3	2	1	1	0	0	0	0	0	3	3	0
EEU526A.4	2	1	2	1	2	0	0	0	1	0	0	0	1	0	0
EEU526A.5	3	0	0	0	0	0	0	0	0	0	0	0	2	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU526(B) INDUSTRIAL ELECTRICAL SYSTEMS

Teaching Scheme: 03 L+ 00T Total: 03

Credits: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2hrs.30min

Course Objectives:

- I. Impart the knowledge about the residential, commercial and industrial electrical installation systems
- II. Impart the knowledge for designing the illumination system for residential, commercial and industrial premises
- III. Impart the knowledge for designing the automation process

Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Industrial Electrical Systems I : HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components' Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Industrial Electrical System Automation: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Books:

1. S.L. Uppal and G.C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007

Reference Books:

1. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Course Outcomes:

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

EEU526B.1 Understand the components of electrical installation.

EEU526B.2 Estimate the electrical wiring systems for residential, and commercial consumers, representing the systems with standard symbols and drawings, SLD.

EEU526B.3 Design the illumination systems form for residential, commercial and industrial premises.

EEU526B.4 Analyze and select the proper size of various electrical system components for industrial electrical installation.

EEU526B.5 Design the process automation for various applications.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU526B.1	2	1	0	0	0	0	0	0	0	0	0	0	1	2	1
EEU526B.2	1	1	2	2	1	0	0	0	0	0	0	0	1	2	1
EEU526B.3	0	1	1	2	3	0	0	0	0	0	0	1	1	1	1
EEU526B.4	0	1	0	2	2	0	0	0	1	0	0	0	1	0	1
EEU526B.5	0	0	0	2	2	0	0	0	0	0	0	1	2	1	2

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU526(C) DIGITAL SIGNAL PROCESSING

Teaching Scheme: 03 L+ 00T Total: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE: 2hrs.30min

Credits: 03

Total Marks: 100

Course Objectives:

- I. Discrete time signal sequences and representation.
- II. Z-transform interpretation in DTS.
- III. Concept of DFT and filter design technique.

Discrete-time signals and systems : Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using Z-transform, Properties of Z-transform for causal signals, Interpretation of stability in Z-domain, Inverse Z-transforms.

Discrete Fourier Transform: Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

Design of Digital filters: Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signalprocessing.

Applications of Digital Signal Processing: Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

Text Books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schaffer, "Discrete Time Signal Processing", Prentice Hall, 1989.

Reference Books:

1. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", Prentice Hall, 1997.
2. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall 1992.
3. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
4. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.
5. <http://www.nptel.iitm.ac.in/>



6. <http://www.ocw.mit.edu/>

Course Outcomes:

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

EEU526 C.1 Represent signals mathematically in continuous and discrete-time, and in the frequency domain

EEU526 C.2 Analyze discrete-time systems using z-transform.

EEU526 C.3 Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.

EEU526 C.4 Design digital filters for various applications.

EEU526 C.5 Apply digital signal processing for the analysis of real-life signals.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU526 C.1	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU526 C.2	2	2	2	3	0	0	0	0	0	0	0	0	2	0	0
EEU526 C.3	2	3	2	2	1	0	0	0	0	0	0	0	2	0	0
EEU526 C.4	2	2	2	1	1	0	0	0	0	0	0	0	2	0	0
EEU526 C.5	2	2	1	1	1	0	0	0	0	0	0	0	2	0	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU526(D) COMPUTER ORGANIZATION

Teaching Scheme: 03 L+ 00T Total: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE: 2hrs.30min

Credits: 03

Total Marks: 100

Course Objectives:

- I. How Computer Systems work & the basic principles
- II. Instruction Level Architecture and Instruction Execution
- III. The current state of art in memory system design

Introduction to computer organization: Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

Memory organization: System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.

Input – output Organization: Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

16 and 32 microprocessors: 80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

Pipelining and different architecture: Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set. VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming

Text Books:

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.

Reference Books:

1. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kaufman, 2011.
2. W. Stallings, "Computer organization", PHI, 1987.
3. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
4. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
5. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India, 1986.
6. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987.



7. B. Govinda rajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
8. P. Able, "8086 Assembly Language Programming", Prentice Hall India.

Course Outcomes:

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

- EEU526 D.1 Understand the computer organization
- EEU526 D.2 Understand the memories of computer
- EEU526 D.3 Understand the Input/Output organization of computer
- EEU526 D.4 Understand the 16 bit and 32 bit Microprocessors
- EEU526 D.5 Understand the pipelining and different architectures of computer systems

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU526 D.1	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU526 D.2	2	2	2	3	0	0	0	0	0	0	0	0	2	0	0
EEU526 D.3	2	3	2	2	2	0	0	0	0	0	0	0	2	0	0
EEU526 D.4	2	2	2	1	1	0	0	0	0	0	0	0	2	0	0
EEU526 D.5	2	2	1	1	1	0	0	0	0	0	0	0	2	0	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU526(E) EMBEDDED SYSTEM

Teaching Scheme: 03 L+ 00T Total: 03

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE: 2hrs.30min

Credits: 03

Total Marks: 100

Course Objectives:

- I. To provide an overview of Design Principles of Embedded System.
- II. To provide clear understanding about the role of firmware, operating systems in correlation with hardware systems.
- III. To provide fundamentals about communication and synchronization

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. Embedded Systems - Raj Kamal, TMH.

Reference Books:

1. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
2. Embedded Systems – Lyla, Pearson, 2013
3. An Embedded Software Primer - David E. Simon, Pearson Education.

Course Outcomes:

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



- EEU526E.1 Understand the selection procedure of Processors in the Embedded domain.
 EEU526E.2 Understand the typical embedded system
 EEU526E.3 Design Procedure for Embedded Firmware.
 EEU526E.4 Expected to visualize the role of Real time Operating Systems in Embedded systems
 EEU526E.5 Expected to evaluate the Correlation between task synchronization and latency issues

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU526E.1	2	2	2	2	0	0	0	0	0	0	0	0	2	0	0
EEU526E.2	2	2	2	3	0	0	0	0	0	0	0	0	2	0	0
EEU526E.3	2	3	2	2	2	0	0	0	0	0	0	0	2	0	0
EEU526E.4	2	2	2	1	1	0	0	0	0	0	0	0	2	0	0
EEU526E.5	2	2	1	1	1	0	0	0	0	0	0	0	2	0	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU527 POWER ELECTRONICS LAB.

Teaching Scheme: 02P

Total: 02

Credits: 01

Evaluation Scheme: 25ICA + 25 ESE

Total Marks: 50

Course Objectives:

- I. Characteristics of various power semiconductor devices
- II. Functioning of various power converters
- III. Simulation of power converters to get desired output

Minimum Eight Experiments must be performed covering the entire Syllabus of EE602, Power Electronics Representative list is given follows: Any THREE from 1 to 5

1. SCR / GTO Characteristics.
2. SCR Turn-on methods.
3. SCR Commutation methods.
4. IGBT / MOSFET Characteristics, Drivers.
5. TRIAC – Triggering modes and Phase control. Any THREE from 5 to 10
6. Single phase Half / Full Controlled Converter.
7. Single phase Dual Converter.
8. Thyristorised / Transistorized D.C. Chopper.
9. Single phase Thyristorised / Transistorised Inverter.
10. Single phase Cycloconverter / A.C. Regulator.

Any TWO from 11 to 15

11. Simulation of Converter/ Chopper.
12. Simulation of Inverter / Cycloconverter.
13. Simulation of Triggering Scheme / PWM Technique.
14. Switched mode Converter/ Rectifier.
15. Uninterruptible Power Supply.

ICA-

Internal Continuous Assessments shall be based on the practical record and knowledge/skills acquired. The performances shall be assessed 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.

Course Outcomes:

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

- | | |
|----------|---|
| EEU529.1 | Select appropriate semiconductor device for building a power converter. |
| EEU529.2 | Develop the power converter required for given application. |
| EEU529.3 | Simulate the power converter before its prototype. |



CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU529.1	2	1	0	0	0	0	0	0	0	0	0	0	1	2	1
EEU529.2	1	1	2	2	1	0	0	0	0	0	0	0	1	2	1
EEU529.3	0	1	1	2	2	0	0	0	0	0	0	1	1	1	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated



EEU528 POWER SYSTEMS – APPARATUS AND MODELLING LAB.

Teaching Scheme: 02P Total: 02

Credits: 01

Evaluation Scheme: 25ICA + 25 ESE

Total Marks: 50

Course Objectives:

To make students aware and understand

- I. Use of MATLAB and PSCAD on power system studies
- II. Electrical power system Modelling for steady state studies
- III. Analyze the symmetrical and unsymmetrical faults

The laboratory consists of minimum ten experiments from following list and any other experiment based on the prescribed syllabus

1. To determine the inductance (L) per kilometre of unsymmetrical three phase line.
2. To determine the inductance of three phase double circuit transmission line.
3. To determine the capacitance of symmetrical spaced three phase transmission line.
4. To find Capacitance of an Unsymmetrical Three-Phase Transposed Line.
5. Analyze the reactive power requirement of lines, voltage profile along the line and VAR compensation.
6. To determine A, B, C, D constants of a given transmission line
7. Simulation of typical power system- familiarization with generator, line and load models.
8. Simulation and analysis for a symmetrical three phase fault.
9. Simulation and analysis of unsymmetrical fault - LL, LG and LLG.
10. To study single machine infinite bus system
11. Determination of steady state power limit of a transmission line.
12. To test over current relay and under/over frequency relay
13. To test differential relay
14. To study different types of circuit breakers
15. Visit to HV/EHV substation, power generating station.
16. To study EHVAC transmission line simulator

ICA-

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

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

Course Outcomes:

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

- | | |
|----------|---|
| EEU528.1 | Select appropriate semiconductor device for building a power converter. |
| EEU528.2 | Develop the power converter required for given application. |
| EEU528.3 | Simulate the power converter before its prototype. |

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU528.1	1	1	0	2	0	0	0	0	0	0	0	0	2	1	0
EEU528.2	2	1	0	2	0	0	0	0	0	0	0	0	2	1	0
EEU528.3	2	1	0	2	3	0	0	0	0	0	0	0	2	1	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated



EEU529 CONTROL SYSTEM LAB

Teaching Scheme: 02P

Total: 02

Credits: 01

Evaluation Scheme: 50ICA

Total Marks: 50

Course Objectives:

- I. Develop the mathematical model of different components of linear feedback control system using simulation and experiments.
- II. Analyze the transient characteristics of different first order and second order systems using simulation and experiments.
- III. Determine the performance of system using root locus.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU523 Control System. Representative list is as follows

1. To determine transfer function of given D.C. generator
2. To study potentiometers and Synchronous as error detector
3. To determine closed loop response of first order system
4. To determine closed loop response of second order system
5. To plot frequency response of given lead compensator
6. To obtain root locus experimentally.
7. Use MATLAB to study effect of feedback gain on system response.
8. Use MATLAB to study effect of damping factor ζ on time control performance specifications.
9. Use MATLAB to obtain root locus for a given system and find performance specifications there from. Study effect of addition of zero and pole on root locus
10. Use MATLAB to get bode plot and obtain gain margin and phase margin for various systems.
11. Use of MATLAB to obtain Nyquist plot & therefrom obtain gain & phase margin for given System
12. Use MATLAB to obtain state space representation from transfer function, find Eigen values, Analyze controllability, observability and stability.

ICA-

Internal Continuous Assessments shall be based on the practical record and knowledge/skills acquired. The performances shall be assessed 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.

Course Outcomes:

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

- | | |
|----------|---|
| EEU530.1 | Select appropriate semiconductor device for building a power converter. |
| EEU530.2 | Develop the power converter required for given application. |
| EEU530.3 | Simulate the power converter before its prototype. |

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU530.1	1	1	0	2	0	0	0	0	0	0	0	0	2	1	0
EEU530.2	2	1	0	2	0	0	0	0	0	0	0	0	2	1	0
EEU530.3	2	1	0	2	3	0	0	0	0	0	0	0	2	1	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated



EEU530 MICROPROCESSOR AND MICROCONTROLLERSLAB

Teaching Scheme: 02P

Total: 02

Credits: 01

Evaluation Scheme: 50ICA

Total Marks: 50

Course Objectives:

- I. Functional hardware components of a microprocessor and microcontroller
- II. Fundamental programming skills for microcontroller-based system
- III. Skill to interface a variety External device with microcontrollers

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU523 Control System. Representative list is as follows

1. Write a a program to store data into given RAM memory locations using direct and indirect addressing modes
2. N 8 bit numbers stored in internal data memory write a program to arrange the numbers in descending order and ascending order
3. Write a program to create a delay of 1000ms. Assume that the oscillator frequency is 12 MHz
4. Write a program to toggle alternate bits at port 1
5. Write a program to receive 8 bits data from port0 port1. Perform AND operation of the received data and send the results to port2
6. Write a program for Hexadecimal up counter
7. Interface DAC and write program to generate square wave
8. Write a program to start A/D converter and store the results in accumulator
9. Interface a stepper motor and write a program to rotate the stepper motor in the direction given in the program
10. Interface a DC motor and write a program to rotate the DC motor for a given speed

ICA-

InternalContinuousAssessmentsshallbebasedonthepracticalrecordandknowledge/skillsacquired .Theperformanceshallassessexperimentwisebyusingcontinuousassessment formats, A andB.

ESE - The End Semester Exam for practical shall be based on performance in one of experiments and maybefollowed bysample questions.

Course Outcomes:

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

EEU530.1 Design the microcontroller-based systems

EEU530.2 Develop the programs in assembly/C language for a microcontroller-based system

EEU530.3 Demonstrates the skills to interface the external devices with microcontrollers

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU530.1	3	1	1	3	0	0	0	0	0	0	0	0	1	3	0
EEU530.2	3	3	3	2	2	0	0	0	0	0	0	0	2	3	0
EEU530.3	3	3	3	2	3	0	0	0	0	0	0	0	2	3	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU621 POWER SYSTEM –OPERATION AND CONTROL

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

Credit: 03
Total Marks: 100

Course Objectives:

- I. Use numerical methods to analyse a power system in steady state.
- II. Explain stability constraints in a synchronous grid.
- III. Understand methods to control the voltage, frequency, and power flow.

Power Flow Analysis: Review of the structure of a power system and its components. Analysis of power flows. Formation of bus admittance matrix, real and reactive power balance equations at a node. Load and generator specifications. Application of numerical methods for solution of non- linear algebraic equations – Gauss Seidel and Newton –Raphson methods for the solution of the power flow equations. Computational issues in large-scale power systems.

Stability Constraints in Synchronous Grid: Swing equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomenon of loss of synchronism in a single-machine infinite bus system following a disturbance like a three—phase fault. Analysis using numerical integration of swing equations (using methods like forward Euler, Runge-Kutta 4th order methods), as well as the equal area criterion. Impact of stability constraints on power system operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

Control of Frequency and Voltage: Turbines and speed-governors, frequency dependence of loads, droop control and power sharing. Automatic generation control. Generation and absorption of reactive power by various components of a power system. Excitation system control in synchronous generators, automatic voltage regulators. Shunt compensators, Static VAR compensators and STATCOMs. tap changing transformers. Power flow control using embedded DC links and phase shifters.

Monitoring and Control: Overview of energy control centre functions: SCADA systems. Phasor measurement units and Wide-area measurement systems. State-estimation, system security assessment. normal, alert, emergency, extremis states of a power system, contingency analysis, preventive control and emergency control.

Power System Economics and Management: Basic pricing principles: Generator cost curves, utility functions, power exchanges, spot pricing. Electricity market models (vertically integrated, purchasing agency, whole-sale competition, retail competition), Demand side-management. transmission and distributions charges, ancillary services, regulatory framework.



Text Books:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.

Reference Books:

1. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
2. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
3. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

Course Outcomes:

On completion of the course, students will demonstrate the ability to

- EEU621.1. Apply numerical methods to analyse a power system in steady state.
 EEU621.2. Investigate the stability of the system using Swing Equation.
 EEU621.3. Solve power system problems for frequency and voltage control.
 EEU621.4. Understand the monitoring and control of a power system.
 EEU621.5. Comprehend the basics of power system economics.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU621.1	2	2	0	1	0	0	0	0	0	0	0	0	1	1	0
U621.2	3	1	0	2	2	0	0	0	0	0	0	0	1	2	0
U621.3	3	1	0	2	2	0	0	0	0	0	0	0	-	3	0
U621.4	1	3	3	2	2	0	0	0	0	0	0	0	2	2	0
U621.5	1	1	0	3	2	0	0	0	0	0	0	0	0	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU622 CONTROL SYSTEM DESIGN

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:

- I. Understand various design specifications.
- II. Design controllers such as P, PI, PID, compensators to satisfy the desired design specifications.
- III. Design controllers using the state-space approach.

Design Specifications: Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

Design of Classical Control System in the time domain: Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

Design of Classical Control System in frequency domain: Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

Design of PID controllers: Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

Control System Design in state space: Review of state space representation and Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

Nonlinearities and its effect on system performance: Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

TextBooks :

- 1.N. Nise, "Control system Engineering", John Wiley, 2000.
- 2.I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
3. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.

Reference Books:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.
2. B. C. Kuo, "Automatic Control system", Prentice Hall, 1995.
3. J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill, 1995.
4. R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", SaundersCollege Pub, 1994



Course Outcomes:

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

- EEU622.1 Understand the design specifications are to be considering as performance indices.
EEU622.2 Design different compensators for linear-time invariant systems in time domain.
EEU622.3 Design of P, PI, PD and PID controllers in time domain and frequency domain.
EEU622.4 Undertake systematic Design of Observer and Reduced order observer.
EEU622.5 Analyse different types of non-linearities in the system by describing function and phase plane analysis.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU622.1	3	2	0	1	0	0	0	0	0	0	0	0	2	3	0
U622.2	3	3	0	2	3	0	0	0	0	0	0	0	1	3	0
U622.3	3	3	0	3	2	0	0	0	0	0	0	0	0	3	0
U622.4	3	3	3	2	3	0	0	0	0	0	0	0	1	3	0
U622.5	3	3	0	3	2	0	0	0	0	0	0	0	0	3	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU623 OPERATION RESEARCH TECHNIQUES

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:

- I. To impart knowledge in concepts and tools of Operations Research
- II. To introduce mathematical models used in Operations Research.
- III. To introduce students to apply these techniques constructively to make effective decisions.

Introduction: Historical Development, Engineering applications of optimization, statement of an optimization problem, Formulation of optimization problem, classification of optimization techniques.

Classical optimization techniques

Single and multi variable optimization without constraints (necessary and sufficient conditions-without proof), Multi variable optimization with equality constraints–Lagrange multiplier method, Optimization with calculus-Kuhn-Tucker conditions.

Linear programming

Graphical method, Simplex method, Revised simplex method, Duality in linear programming (LP), Dual simplex method, Sensitivity analysis, Balanced and unbalanced transportation problem–north west corner method, least cost method and Vogel's approximation method for finding initial basic feasible solution, stepping stone method to find optimum solution, Assignment problem – Hungarian method for finding optimum solution.

Non linear programming: Unimodal function, One dimensional minimization-unrestricted search (search with fixed step size and accelerated step size), Fibonacci search method and Golden section method, Unconstrained optimization-direct search method (simplex method), descent method (steepest descent method and conjugate gradient method), Constrained optimization–sequential quadratic programming method.

Dynamic programming: Multistage decision processes, concept of sub optimization and principle of optimality, linear programming as a case of dynamic programming, Applications for solving unit commitment problem.

Text Books:

1. Engineering Optimization-Theory and Practice, S.S.Rao Wiley Eastern Ltd.2005
2. Operations Research–Theory and Applications, J.K. Sharma, Macmillan India Ltd., New Delhi. -2009

Reference Books:

1. Introduction Operations Research, Fredrick S.Hiller Gerald J.L. Lieberman Tata Mc Graw Hill Pub. Co., New Delhi.-2004
2. Operations Research, H.A.Taha PHI, New Delhi.-2000



3. K. Deb, "Optimization for Engineering Design—Algorithms and Examples", Prentice-Hall of India Pt. Ltd., New Delhi, 1995.
4. Linear Programming, S.I.Gauss.
5. <http://www.nptel.iitmac.in>

Course Outcomes:

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

- EEU624.1. Formulate the mathematical model for optimization problems.
- EEU624.2. Select proper method to solve a given optimization problem.
- EEU624.3. Understand the characteristics of different types of decision-making environments and the appropriate decision-making approaches.
- EEU624.4. Use quantitative methods and techniques for effective decisions-making.
- EEU624.5. Apply appropriate optimization techniques to solve the engineering optimization problems (in general) and electrical engineering optimization problems in specific.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU623.1	3	2	0	1	2	0	0	0	0	0	0	0	0	0	0
U623.2	3	3	0	2	3	0	0	0	0	0	0	0	0	0	0
U623.3	2	1	0	2	2	0	0	0	0	0	0	0	0	0	0
U623.4	2	2	0	2	2	0	0	0	0	0	0	0	0	0	0
U623.5	3	1	0	3	3	0	0	0	0	0	0	0	0	0	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU624A POWER SYSTEM PROTECTION

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

Credit: 03
Total Marks: 100

Course Objectives:

To make students aware and understand

- I. Various protection schemes for different power system components.
- II. The importance of Digital relays.
- III. Develop various protection schemes.

Introduction and Components of a Protection System: Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers

Faults and Over-Current Protection: Review of Fault Analysis, Sequence Networks. Introduction to Over current Protection and over current relay co-ordination.

Equipment Protection Schemes: Directional, Distance, Differential protection, Transformer and Generator protection. Bus bar Protection and Bus Bar arrangement schemes.

Digital Protection: Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.

Modelling and Simulation of Protection Schemes: CT/PT modelling and standards, Simulation of transients using MATLAB or Electro-Magnetic Transients (EMT) programs. Relay Testing.

System Protection: Effect of Power Swings on Distance Relaying System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchrophasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Text Books:

1. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.
2. Y. G. Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.

Reference Books:

1. A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.
2. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their



Applications”, Springer, 2008.

3. D. Reimert, “Protective Relaying for Power Generation Systems”, Taylor and Francis, 2006.

Course Outcomes:

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

EEU624A.1 Understand the different components of a protection system.

EEU624A.2 Evaluate fault current due to different types of fault in a network.

EEU624A.3 Understand the protection schemes for different power system components.

EEU624A.4 Understand the basic principles of digital protection.

EEU624A.5 Understand system protection schemes, and the use of wide-area measurements.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU624A.1	2	2	0	1	0	0	0	0	0	0	0	0	1	1	0
EEU624A.2	3	1	0	2	2	0	0	0	0	0	0	0	1	2	0
EEU624A.3	3	1	0	2	2	0	0	0	0	0	0	0	0	3	0
EEU624A.4	1	3	3	2	2	0	0	0	0	0	0	0	2	2	0
EEU624A.5	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated



EEU624 B ENERGY CONSERVATION IN ELECTRICAL UTILITIES

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

Credit: 03
Total Marks: 100

Course Objectives:

- I. Energy conservation management system.
- II. Energy audit as per energy conservation act.
- III. Lighting level and motor efficiency.

Energy Conservation: Energy Conservation Principles, Energy conservation Planning, Energy conservation in small- and Large-scale industries, Energy conservation in electrical generation, transmission and distribution, Energy Conservation Act 2001 and Bureau of Energy Efficiency.

Energy Audit: Aim of energy Audit, Strategic of Energy Audit, Energy management Team Consideration in implementing energy conservation Program, Instruments for energy audit, Energy audit of Electrical Systems, HVAC, Buildings, Economic analysis.

Demand Side Management: Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy, Planning, Implementation and its application, Customer Acceptance & its implementation issues.

Efficiency in Motors and Lighting system: Load scheduling/shifting, **Motor Drives**-motor efficiency testing, energy efficient motors, motor speed control. **Lighting**- lighting levels, efficient options, fixtures, day lighting, timers, Energy efficient windows, UPS selection, Installation operation and maintenance.

Energy management systems: Introduction, energy conservation policy and performance assessment, baseline and benchmarking, action planning, monitoring and targeting, energy management information systems, CUSUM techniques.

Text Books

1. Doty S. and Turner W. C. (2012); Energy Management Handbook, Eighth Edition, Fairmont Press
2. Bureau of Energy Efficiency (BEE) (2012); Study material for Energy Managers and Auditors Examination: Paper I to IV
3. Bureau of Energy Efficiency (BEE) (2015); Electrical Efficiency in Electrical Utilities- Book3



Reference Books

1. Thumann A. and Mehta D. P. (2008); Handbook of Energy Engineering, Sixth Edition, Fairmont Press
2. Capehart B. L. Turner W. C. and Kennedy W. J. (2011); Guide to Energy Management, Seventh Edition. Fairmont Press
3. Kao C. (1999); Energy Management in Illumination System, First Edition, CRC Press
4. <http://www.nptel.iitm.ac.in/>
5. <http://www.ocw.mit.edu/>

Course Outcomes:

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

EEU624B.1. Understand the energy conservation as per conservation legislation in electrical utility.

EEU624B.2. Describe the energy audit in electrical systems.

EEU624B.3. Explain the evolution of Demand Side Management.

EEU624B.4. Illustrate motor and lighting system efficiency.

EEU624B.5. Understand energy management systems informative strategy and policy.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU624B.1	2	2	1	1	1	0	0	0	0	0	0	0	2	0	0
EEU624B.2	2	3	2	2	2	0	0	0	0	0	0	0	2	0	0
EEU624B.3	2	3	3	2	2	0	0	0	0	0	0	0	2	0	0
EEU624B.4	2	2	1	2	2	0	0	0	0	0	0	0	2	0	0
EEU624B.5	3	3	3	2	3	0	0	0	0	0	0	0	2	0	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU624D OBJECT ORIENTED PROGRAMMING

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

Credit: 03
Total Marks: 100

Course Objectives:

- I. Standard tools and techniques for software development
- II. Use of object-oriented approach.
- III. An appropriate framework for automated unit

Abstract Data Types, Functions and Operations: Abstract data types and their specification, How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.

Basic Features: Features of object-oriented programming, Encapsulation, object identity, polymorphism – but not inheritance.

Design of Patterns and its study: Inheritance in OO design, Design patterns. Introduction and classification. The iterator patterns.

Implementation of OO features: Model-view-controller pattern. Commands as methods and as objects., Implementing OO language features. Memory management. Generic types and collections

GUIs and development processes: GUIs Graphical programming with Scala and Swing, The software development process.

Text Books:

1. Barbara Liskov, Program Development in Java, Addison-Wesley,
2. Robert Lafore Object oriented Programming in Microsoft C++

Reference Books:

1. Dusty Phillips Object oriented Programming in Python
2. Mrklutz Programming in Python powerful Object-oriented Programming
3. Bill lubonovic Introducing Python

Course Outcomes:

After taking the course, students will be able to:

- EEU624D.1 Specify simple abstract data types and design implementations, using abstraction functions to document them.
- EEU624D.2 Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
- EEU624D.3 Name some common object-oriented design patterns and give examples of their use.



EEU624D.4 Apply some common object-oriented design patterns and give examples of their use.

EEU624D.5 Design applications with an event-driven graphical user interface.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU624D.1	3	2	0	1	0	0	0	0	0	0	0	0	2	3	0
EEU624D.2	3	3	0	2	3	0	0	0	0	0	0	0	1	1	0
EEU624D.3	1	2	0	2	2	0	0	0	0	0	0	0	0	2	0
EEU624D.4	3	3	3	2	3	0	0	0	0	0	0	0	1	3	0
EEU624D.5	1	3	0	3	2	0	0	0	0	0	0	0	0	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU624E- INTERNET OF THINGS

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

Credit: 03
Total Marks: 100

Course Objectives:

- I. Fundamentals of IoT
- II. Different types of IOT sensors
- III. IoT applications in Electrical Engineering

INTRODUCTION: Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device.

IOT SENSORS: Magnetization, Hysteresis and hysteresis loop, Methods of analysis of ferromagnetic circuits, Fringing and Leakage effects of air gap, Eddy current, eddy current and hysteresis losses, Equivalent circuits of iron core reactors, Saturable reactors.

TECHNOLOGICAL ANALYSIS: Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module.

IOT DEVELOPMENT EXAMPLES: ACOEM Eagle – En Ocean Push Button – NEST Sensor – Ninja Blocks -Focus on Wearable Electronics.

IOT PROJECTS: Creating the sensor project - Preparing Raspberry Pi/ ARM Cortex - Clayster libraries – HardwareInteracting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values – Exporting sensor data - Creating the actuator project- Hardware - Interfacing the hardware -Creating a controller - Representing sensor values - Parsing sensor data – Calculating control states - Creating a camera - Hardware -Accessing the serial port on RaspberryPi/ ARM Cortex - Interfacing the hardware - Creating persistent default settings – Adding configurable properties - Persisting the settings - Working with the current settings - Initializing the camera

Text Books:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
2. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

Reference Books:

1. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market



2. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014

Course Outcomes:

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

- EEU624E.1. Understand the basics of IoT.
- EEU624E.2. Compare first generation and advanced IoT sensors.
- EEU624E.3. Analyse energy storage, power management, RF and sensing module.
- EEU624E.4. Develop applications using sensors and IoT components.
- EEU624E.5. Design IoT project using Raspberry pi/ Arm cortex.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU 624E.1	2	2	1	1	1	0	0	0	0	0	0	0	2	0	0
EEU 624E.2	2	3	2	2	2	0	0	0	0	0	0	0	2	0	0
EEU 624E.3	2	3	3	2	2	0	0	0	0	0	0	0	2	0	0
EEU 624E.4	2	2	1	2	2	0	0	0	0	0	0	0	2	0	0
EEU 624E.5	3	3	3	2	3	0	0	0	0	0	0	0	2	0	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

EEU625A ELECTROMECHANICAL ENERGY CONVERSION

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

Credit: 03
Total Marks: 100

Course Objectives:

- I. Explain the Terminology of Electromagnetic and Electromagnetic Induction.
- II. Induced voltage, armature reaction and torque
- III. Dynamics of DC machines

Electrical and Magnetic Field Calculations: Magnetic circuit calculations for devices and machines, Theory of electrostatic and magnetic fields, Fundamental equations, Fields of simple geometries.

Electromechanical Energy Conversion: Energy storage in singly and multiply-excited systems, Mechanical force and stored energy, Electromechanical transducers and their analysis, Reluctance type devices, Energy dissipation- resistance, eddy current, hysteresis and dielectric loss, Lagrange's equation.

Induced Voltage, Armature Reaction and Torque: Induced voltage in windings of ac and dc machines, Armature reaction- EMF of a single coil and uniformly distributed conductors, Rotating magnetic fields in ac machines, Torque in dc and three-phase ac machine, Torque of mutually coupled coils.

Dynamics of Electric Machines: Dynamics of dc machines, Dynamic response of first and second order linear systems, Voltage regulation of separately-excited dc generator, Speed control of separately –excited dc motor, Synchronous-machine dynamics, Parallel operation and synchronizing of alternators.

Text Books:

1. Electro-mechanical energy conversion with dynamics of machines, Rakosh Das Begamudre, Second Edition, New Edge International Publishers, New Delhi.-2008
2. Electric Machines, I J Nagrath and D P Kothari, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 2003

Reference Books

1. Electromechanical Energy Conversion, Vembu Gauri shankar, McGraw Hill. Thumann A. and Mehta D. P. (2008); Handbook of Energy Engineering, Sixth Edition, Fairmont Press
2. Principles of Electro-mechanical energy conversion, Del Toro V, Prentice-Hall, Englewood Cliffs. N. J.
3. <http://www.nptel.iitm.ac.in/>
4. <http://www.southampton.ac.uk/>

Course Outcomes:

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

- EEU625A.1. Understand the principals of electromechanical energy conversion

- EEU625A.2. Perform electric and magnetic field calculations for devices and machines.
 EEU625A.3. Analyse electromechanical transducers and energy conversion process.
 EEU625A.4. Determine induced voltages and torque in DC & Induction Machines.
 EEU625A.5. Determine dynamic response of linear systems and machines.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU 625A.1	2	2	1	1	1	0	0	0	0	0	0	0	2	0	0
EEU 625A.2	2	3	2	1	1	0	0	0	0	0	0	0	2	0	0
EEU 625A.3	2	3	3	1	1	0	0	0	0	0	0	0	2	0	0
EEU 625A.4	2	2	1	1	1	0	0	0	0	0	0	0	2	0	0
EEU 625A.5	3	3	3	1	1	0	0	0	0	0	0	0	2	0	0

0- Not correlated 1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU625B ENERGY EFFICIENCY IN ELECTRICAL UTILITIES

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

Credit: 03
Total Marks: 100

Course Objectives:

- I. Electrical power system and tariffs in India.
- II. Need and Importance of energy saving practices in electrical utilities.
- III. Energy saving opportunities in drives, fans, pumps, lighting, DG sets, etc.

Electrical systems: Introduction to Electrical energy systems, Tariff and economic considerations, T & D losses, Electrical load and various factors, Power factor and its introductory improvement techniques, Energy Efficient Technologies in Electrical Systems

Electric Motors and Drives: Energy Efficient Motors, Factors affecting Energy efficiency of a motor Introduction to power electronic controllers, soft starters and block diagrams of stator voltage and stator frequency controlled three phase induction motor drives, block diagrams of controlled rectifier and chopper fed dc shunt motor.

Fans and Blowers: Types, efficient system operation, Capacity selections, Performance assessment of fans and blowers, Energy conservation opportunities

Pumping systems: Types, Performance evaluation, efficient system operation, Energy conservation opportunities in pumping systems

Lighting systems: Basic terms of lighting systems recommended illumination level, Methodology of lighting systems, energy efficiency study, and Energy conservation opportunities.

DG Set and UPS systems: Introduction, Selection and capacity factor, Operational parameters, Performance assessment of DG Systems, Energy conservation opportunities, Block diagram and working of UPS Energy Efficiency in Renewable Energy Systems: Energy efficiency in solar and wind energy systems.

Text Books:

1. Doty S. and Turner W. C. (2012); Energy Management Handbook, Eighth Edition, Fairmont Press
2. Bureau of Energy Efficiency (BEE) (2012); Study material for Energy Managers and Auditors Examination: Paper I to IV
3. Bureau of Energy Efficiency (BEE) (2015); Electrical Efficiency in Electrical Utilities- Book3

Reference Books

1. Thumann A. and Mehta D. P. (2008); Handbook of Energy Engineering, Sixth Edition, Fairmont Press
2. Capehart B. L. Turner W. C. and Kennedy W. J. (2011); Guide to Energy Management, Seventh Edition. Fairmont Press
3. Kao C. (1999); Energy Management in Illumination System, First Edition, CRC Press

4. <http://www.nptel.iitm.ac.in/>
5. <http://www.ocw.mit.edu/>

Course Outcomes:

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

- EEU625B.1. Understand the components of electrical energy systems.
- EEU625B.2. Apply energy efficient technologies in electrical utilities.
- EEU625B.3. Utilize the various energy conservation techniques and practices.
- EEU625B.4. Evaluate the performance of various types of electrical loads.
- EEU625B.5. Select the proper capacity of various equipment's/accessories for given applications.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU 625B.1	2	1	0	0	0	0	0	0	0	0	0	0	2	2	0
EEU 625B.2	2	2	1	0	2	0	2	0	0	0	0	0	3	2	0
EEU 625B.3	2	2	1	1	2	1	0	0	0	0	0	2	3	1	0
EEU 625B.4	3	2	0	0	0	0	1	0	0	0	0	0	3	2	0
EEU 625B.5	3	0	0	0	3	0	1	0	0	0	0	0	3	1	0

0- Not correlated 1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

ETU 631 ELECTRONICS DESIGN LABORATORY

Teaching Scheme: 01T+ 04P

Total: 05

Credit: 03

Evaluation Scheme: 55 ICA + 50 ESE

Total Marks: 100

Course Objectives:

- I. To study various measurement devices, their characteristics, operation, and limitations
- II. To simulate and synthesize the program on a hardware development board.
- III. To study statistical data analysis

Minimum Eight Experiments to be performed to achieve course outcomes.

Following list of laboratory experiments is indicative but not limited to following topics.

1. Designing signal Conditioning circuit for Pressure Measurement
2. Designing signal Conditioning circuit for Temperature Measurement
3. Designing signal Conditioning circuit for Torque Measurement
4. Designing signal Conditioning circuit for Strain Measurement
5. Experimental study for the characteristics of ADC and DAC
6. FPGA implementation of any combinational digital logic design
7. FPGA implementation of any sequential digital logic design
8. Stepper motor control using microcontroller.
9. Temperature control using microcontroller.
10. Serial communication between microcontroller and PC

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

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

Course Outcomes:

- ETU 631.1 Learn about various measurement devices, their characteristics, operation and limitations.
- ETU 631.2 Understand the implementation on hardware development board
- ETU 631.3 Understand statistical data analysis



CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU631.1	2	0	1	0	0	0	0	1	1	0	0	0	2	1	0
EEU631.2	2	0	2	0	2	0	0	1	1	0	0	0	2	1	0
EEU631.3	2	0	2	0	2	0	0	1	1	0	0	0	2	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated



EEU626 POWER SYSTEM –OPERATION AND CONTROL LAB

Teaching Scheme : 02 P Total:02

Evaluation Scheme : 50 ICA

Credit: 01

Total Marks: 50

Course Objectives:

To make the students aware and understand:

- I. Use numerical methods to analyse a power system in steady state.
- II. Understand stability constraints in a synchronous grid.
- III. Understand methods to control the voltage, frequency, and power flow.

Minimum eight hands-on experiments related to the course contents of EEU626 Power System Operation and Control Lab to be performed. Representative list is as follows.

1. To carry out load flow using Gauss-Seidel method
2. To carry out load flow using NR method
3. Solution of Swing equation by Euler method
4. Solution of swing equation by RK2 method
5. Unit commitment using equal incremental cost method.
6. Modelling and simulation of multi-machine power system
7. Evaluation of the effect of various contingencies and to compute sensitivity factors.
8. To determine the effect of surge impedance loading
9. Determination of steady state power limit of a transmission line.

ICA - Internal Continuous Assessments 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 the experiments and may be followed by sample questions.

Course Outcomes:

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

EEU626.1 Model and simulate multi-machine power systems for steady state and transient studies.

EEU626.2 Simulate the steady state and transient operations using MATLAB.

EEU626.3 Perform various contingencies on power system and compute sensitivity factors.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU626.1	2	2	2	1	2	0	0	0	0	0	0	0	1	1	1
EEU626.2	2	1	1	2	2	0	0	0	0	0	0	0	1	2	2
EEU626.3	1	3	2	2	2	0	0	0	0	0	0	0	1	3	2

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU627 CONTROL SYSTEM DESIGN LAB

Teaching Scheme : 02 P Total:02
Evaluation Scheme : 50 ICA

Credit: 01
Total Marks: 50

Course Objectives:

To make the students aware and understand:

- I. Develop the mathematical model of different components of linear feedback control system using simulation and experiments.
- II. Analyse the transient characteristics of different first order and second order systems using simulation and experiments.
- III. Determine the performance of system using root locus.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU622 Control System Design. Representative list is as follows [Minimum five from part A & remaining from part B]

Part A:

1. To plot frequency response of given lead compensator
2. To plot frequency response of given lag compensator
3. To plot frequency response of given Lag-Lead compensator.
4. Design & implement a lag compensator for given plant to meet the given specifications.
5. Design & implement a lead compensator for given plant to meet the given specifications.
6. To determine the describing function of given relay.
7. To determine effect of relay type of nonlinearity on closed loop system
8. To determine the phase plane trajectory for given nonlinear system

Part B:

1. Overview of functions in MATLAB control system toolbox
2. To obtain the phase plane plot of given mechanical system
3. Obtain the phase plane plot of given electrical system.
4. To obtain state model for given transfer function
5. To obtain transfer function from given state model

ICA - Internal Continuous Assessments 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 the experiments and may be followed by sample questions.



Course Outcomes:

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

EEU627.1 Design and fabricate different compensators.

EEU627.2 Generate characteristics of different types of non-linearities.

EEU627.3 Use software to demonstrate different performance characteristics of LTI systems via state space modelling.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU627.1	2	0	1	0	0	0	0	1	1	0	0	0	2	1	0
EEU627.2	2	0	2	0	2	0	0	1	1	0	0	0	2	1	0
EEU627.3	2	0	2	0	2	0	0	1	1	0	0	0	2	1	0

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

EEU628 MINOR PROJECT

Teaching Scheme : 02 P

Total: 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

For minor project group of four students is to be formed. Innovative ideas of students are expected to be implemented in hardware / fabrication/prototype development/experimentation.

Two groups will be assigned to each guide so that the same students will come for the main project of final year.

Course Objectives:

- I. The main aim of this course is to demonstrate the important attributes like critical thinking, creativity, collaborative efforts and communication skills.
- II. To make students aware with the process involved in making product from idea.
- III. To make student communicate effectively on complex engineering activities with the engineering community and to make students to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes:

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

EEU628.1. Understand community needs.

EEU628.2. Convert idea into product.

EEU628.3. Work in group and Communicate effectively.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEU628.1	1	2	3	2	2	1	2	1	2	1	2	1	1	1	1
EEU628.2	2	2	2	2	2	3	3	2	2	2	2	2	1	2	2
EEU628.3	1	2	1	2	1	3	3	3	2	3	2	2	1	2	3

0- Not correlated

1 - Weakly Correlated

2- Moderately Correlated

3- Strongly Correlated

**GOVT. COLLEGE OF ENGINEERING,
AMRAVATI**

DEPARTMENT OF ELECTRICAL ENGINEERING



PROPOSED CURRICULUM
For
B. TECH. (Electrical Engineering)

2020- 20201

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 Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		Total	
							MSE	TA	ESE	ICA	ESE		
BSC	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	Introduction to Constitution of India	1	---	---	1	---	---	60	---	---	60	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	24	150	50	360	150		710	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	SHU423	Cyber law and ethics	2	--	0	2	30	10	60	-	-	100	2
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	1	---	---	1	---	---	60	---	---	60	0
	Total		18	1	6	25	150	50	360	150	---	710	21

SHU321C TRANSFORM AND STATISTICAL METHODS

Teaching Scheme: 03Th+ 01Tut = 04 Total

Total Credits: 04

Evaluation Scheme: 30MSE+60ESE+10TA

Total Marks: 100

Course Objectives:

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

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)

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, 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 successful completion of the course the student will be able to

- SHU321(C).1 To solve partial differential equations and also to solve wave and heat equations.
- SHU321(C).2 To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system.
- SHU321(C).3 Tackle problems related to continuous and discrete probability distributions.

SHU322C INTEGRAL CALCULUS AND PROBABILITY

Teaching Scheme: 03Th+ 01Tut = 04 Total

Total Credits: 04

Evaluation Scheme: 30MSE+60ESE+10TA

Total Marks: 100

Course Objectives:

- I. To study method solution of partial differential equations and apply it to solve wave and heat equations.
- II. To learn Laplace transform and its properties. Apply it to solve differential equation and to calculate stability of LTI system.
- III. 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:

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.
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 successful completion of the course the student will be able to

- | | |
|-------------|--|
| SHU322(C).1 | To solve partial differential equations and also to solve wave and heat equations. |
| SHU322(C).2 | To use knowledge of Laplace Transform and to solve differential equation and to calculate stability of LTI system. |
| SHU322(C).3 | Tackle problems related to continuous and discrete probability distributions. |

ETU331C Analog Electronic Circuits

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

Credit: 03
Total Marks: 100

Course Objectives:

The subject aims to provide the student with:

- I. To study the various electronic circuits using Diode, Transistor and Mosfet
- II. To understand the working of various Differential, multi-stage amplifiers
- III. 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 coupled 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 Integrated Circuits" 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
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit: 03
Total Marks: 100

Course Objectives:

To make students aware and understand

- I. Basic concept of Magnetic Circuit and Electromagnetic force and torque
- II. Construction, Operation and testing of dc machines
- III. 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

- I. Analyze electrical network problems.
- II. Determine transient and steady state behavior of the electrical networks.
- III. 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 Shyammmohan 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

- I. Challenges of using sources of energy efficiently and effectively
- II. The energy conversion systems for various power plants
- III. The importance and relevance of renewable energy sources

Module 1: Thermal and Hydro Power plant (12Hours)

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.

Nuclear and Diesel Power plant: Methods of producing nuclear reactions, functions of different components of nuclear plant, functions of different components of diesel plant.

Module 2: 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 3: 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 4: 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 5: Other Renewable energy resources (12 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. 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.

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 Resources, 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

Evaluation scheme: 60 ESE

Credit: 00

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-

SHU322.1 Understand and remember the knowledge of basic information about Indian Constitution.

SHU322.2 Apply the knowledge of fundamental rights and fundamental duties.

ETU332C Analog Electronic Lab

Teaching Scheme : 02 P
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01
Total Marks: 50

Course Objectives:

To make students aware and understand to

- I. Design, build, test and analyze performance of various electronic circuits using Diode, Transistor and FET
- II. Have experience of design and implementation of various amplifiers
- III. 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:

- I. Various parts of d.c. machine and transformer
- II. Operation and performance of dc motors
- III. 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

Evaluation Scheme : 50 ICA

Credit: 01

Total Marks: 50

Course Objectives:

To make the students aware and understand:

- I. Various electrical circuit theorems.
- II. Two port network parameters.
- III. 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 Construct simple electrical circuits using suitable elements
- EEU 325.2 Perform experiments 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:

- I. To acquire the basic knowledge of digital logic circuit components
- II. To understand and analyze and design combinational logic circuits using gates and MSIs
- III. To design and realize combinational and sequential digital electronic circuits

Module 1 Fundamentals of Digital Systems and logic families (7Hours)

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

Module 2: Combinational Digital Circuits (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, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 3: Sequential circuits and systems (7Hours)

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

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

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

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 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 logic circuits. |
| 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

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 03

Total Marks: 100

Course Objectives:

To make students aware and understand

- I. Basic concept of AC machine winding and revolving magnetic field
- II. Operation and testing of Induction machine (single and three phase)
- III. 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 of parameter 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:

- I. Understand the concepts of continuous time and discrete time systems.
- II. Able to find output of LTI system by convolution.
- III. 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. Schaffer, "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:

- I. Electrostatic boundary-value problems.
- II. The types and properties of magnetic materials.
- III. 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)

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

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. |

	Cyber Law and Ethics		2 credits
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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:

- I. Different bridges and their applications.
- II. Different transducers and their working principles.
- III. 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.

ETU432C Digital Electronics Lab

Teaching Scheme : 02 P
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01
Total Marks: 50

Course Objectives:

- I. To acquire the hands-on experience of digital component, circuit realization using bread board
- II. To realize combinational logic circuits using Logic gates and MSIs
- III. 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
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01
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 X_d and X_q 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.

SHU-424 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-

- I. Be aware of various environmental factors and their preservation.
- II. Teach them how to protect Environment and natural resources.
- III. 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:

- SHU424.1 Convey the Environmental awareness among peoples.
- SHU424.2 Apply Conservation of various natural resources and environmental factors.
- SHU424.3 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.

Equivalence-I

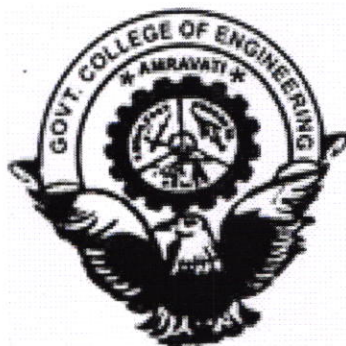
S. N.	Course in old Scheme (184)			Equivalent course in new scheme (155)		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU303	Engineering Mathematics - III	3	SHU321C	Transform and Statistical methods	4
2	ETU311	Electronic Devices and Circuits	3	ETU331C	Analog Electronic 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	SHU321 C	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

**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.

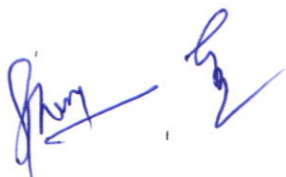
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

* For Direct second year admitted students

[Signature]

B. Tech. (Electrical Engineering)

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

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B. Tech. (Electrical Engineering)

SEM V												
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme					
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	Practical	Total
PCC	EEU521	Power Electronics	3	---	---	3	30	10	60	-	-	100
PCC	EEU522	Power Systems – Apparatus and Modelling	3	1	---	3	30	10	60	-	-	100
PCC	EEU523	Control System	3	1	---	4	30	10	60	-	-	100
PCC	EEU524	Microprocessor and Microcontrollers	3	---	---	3	30	10	60	-	-	100
SHMC	EEU525	Industrial Organization & Management	3	---	---	3	30	10	60	-	-	100
PEC	EEU526	Program Elective - I	3	---	---	3	30	10	60	-	-	100
LC	EEU527	Power Electronics Lab	---	---	2	2	-	-	-	25	25	50
LC	EEU528	Power Systems – Apparatus and Modelling Lab	---	---	2	2	-	-	-	25	25	50
LC	EEU529	Control Systems Lab	---	---	2	2	-	-	-	50	-	50
LC	EEU530	Microprocessor and Microcontrollers Lab	---	---	2	2	-	-	-	50	-	50
		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 Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	Theory	ESE	ICA	Practical		Total
PCC	EEU621	Power Systems –Operation and Control	3	---	---	3	30	10		60	-	ESE	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
QEC	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 Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory			Practical		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	

[Signature]

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

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) Embedded 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	ETU331C	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	ETU322C	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	SHU423C	Biology - I	2		---	
15	EEU424	Electrical Measurement and Instrumentation Lab	3	EEU306	Electrical Measurement and Instrumentation Lab	1
16	ETU432C	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	

Gulhane

5/ Head, Mathematics

Petle

Member secretary
BoS Science & Humanities

S. V. Srinivas

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. Hame	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 Analysis 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	Bhaveskumar 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. Dhokane	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	EEP222 Power System Dynamics and Stability	Not Available	
3	Dr. G. A. Dhokane	EEP223 HVDC and FACTS	Not Available	
4	Dr. V. B. Virulkar	EEP224 Electric 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. Necessity 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 successful completion of the course the student will be 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.



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 successful completion of the course the student will be 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
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit: 03
Total Marks: 100

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 coupled 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 Integrated Circuits" 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
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit: 03
Total Marks: 100

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 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 Shyamamohan Tata Mc Graw Hill 2005
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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 required.

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 Resources, 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
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01
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.
- 15 To 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
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01
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
Evaluation Scheme : 50 ICA

Credit: 01
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 Construct simple electrical circuits using suitable elements
EEU 325.2 Perform experiments 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

Evaluation Scheme: 30 MSE +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 03

Total Marks: 100

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 logic families (7Hours)

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

Module 2: Combinational Digital Circuits (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, Demultiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 3: Sequential circuits and systems (7Hours)

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J-K and D-type flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

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

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

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 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.

Course Outcomes:

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 logic circuits.

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
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit: 03
Total Marks: 100

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 of parameter 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.
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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. Schaffer, "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)

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator ∇ , gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

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. |



422
SHU-422 ENVIRONMENTAL STUDIES

Teaching Scheme: 02 L
Evaluation scheme: 60 ESE

Total: 02
ESE Duration: 2:30 hrs

Credit: 00
Total Marks: 60

Course objectives:-

The objectives of offering this course are to-

- Be aware of various environmental factors and their 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) Environmtental Studies, Benny Joseph, 1st edition, 2005, Tata Mcgraw-Hill Publ.



EEU424 Electrical Measurement and Instrumentation Lab

Teaching Scheme : 02 L + 02 P
Evaluation Scheme : 50 ICA

Total 04

Credit: 03
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

Evaluation scheme: 20TA+30ESE

ESE Duration: 1Hr 30 Min.

Credit: 00

Total Marks: 50

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

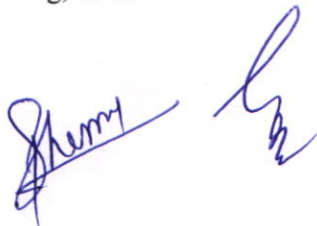
Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Moral Leadership, Code of Conduct, Corporate Social Responsibility

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

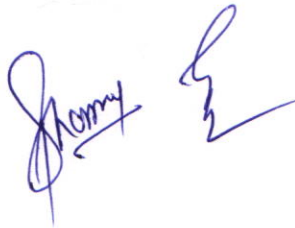


3. Ethics and the Conduct of Business, John R Boatright, Pearson Education, New Delhi, 2003
4. Fundamentals of Ethics for Scientists and Engineers, Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford, 2001
5. Business Ethics: Decision Making for Personal Integrity and Social Responsibility, 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.

Two handwritten signatures in blue ink. The signature on the left is more complex, with a large loop and the word 'Romy' visible. The signature on the right is simpler, consisting of a few connected strokes.

ETU432C Digital Electronics Lab

Teaching Scheme : 02 P
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01
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
Evaluation Scheme : 50 ICA

Total: 02

Credit: 01
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 X_d and X_q 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.

**GOVT. COLLEGE OF
ENGINEERING,
AMRAVATI**



**CURRICULUM
B. TECH. (ELECTRICAL)
VII and VIII Semester**

Department of Electrical Engineering

SEM III													
Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
		Theory Hrs /week	Tutorial Hrs /week	Practical Hrs /week	Total	Theory				Practical		Total	
						TA	CT1	CT2	ESE	ICA	ESE		
SHU303	Engineering Mathematics - III	3	--	---	3	10	15	15	60	---	---	100	3
ETU311	Electronic Devices and Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU301	Signals & Systems	3	1	---	4	10	15	15	60	---	---	100	4
EEU302	Network Analysis	3	1	---	4	10	15	15	60	---	---	100	4
EEU303	Electrical Measurement and Instrumentation	3	---	---	3	10	15	15	60	---	---	100	3
ETU312	Electronic Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU304	Signals & Systems Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU305	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU306	Electrical Measurement and Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
SHU305	General Proficiency - II	1	---	2	3	---	---	---	---	25	25	50	2
Total		16	2	10	28	50	75	75	300	150	100	750	23
SEM IV													
SHU401	Engineering Mathematics - IV	3	--	---	3	10	15	15	60	---	---	100	3
EEU401	Pulse & Digital Circuits	3	1	---	4	10	15	15	60	---	---	100	4
EEU402	Electrical Machines - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU403	Energy Resources & Generation	3	---	---	3	10	15	15	60	---	---	100	3
EEU404	Electromagnetic Engineering	3	1	---	4	10	15	15	60	---	---	100	4
SHU402	Engineering Mathematics Lab	1	---	2	3	---	---	---	---	25	25	50	2
EEU405	Pulse & Digital Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU406	Electrical Machines - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU407	Numerical Methods Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU408	Computational Lab - I	---	---	2	2	---	---	---	---	25	25	50	1
Total		16	2	10	28	50	75	75	300	125	125	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.

SEM V													
EEU501	Electrical Machines -II	3	---	---	3	10	15	15	60	---	---	100	3
EEU502	Power System Analysis- I	3	---	---	3	10	15	15	60	---	---	100	3
EEU503	Control System - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU504	Introduction to Microprocessor and Microcontrollers	3	---	---	3	10	15	15	60	---	---	100	3
EEU505	Industrial Organization & Management	3	---	---	3	10	15	15	60	---	---	100	3
EEU506	Electrical Machines - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU507	Power System Analysis - I Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU508	Control System - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU509	Introduction to Microprocessor and Microcontrollers Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU510	Computational Lab-II	1	---	2	3	---	---	---	---	25	25	50	2
EEU511	Self Study - I	---	---	----	0	---	---	---	---	25	---	25	2
Total		16	0	10	26	50	75	75	300	150	100	750	23

NOTE :

1) Self study - I is based on one class test each on the basis of 20% curriculum of the courses EEU501,EEU502,EEU503,EEU504 declared by respective course coordinator at the beginning of the semester.

2) One faculty member shall be appointed as course coordinator for self study - I and his/her teaching work-load shall be consider 1 hr/week

SEM VI													
EEU601	Power Electronics	3	--	---	3	10	15	15	60	---	---	100	3
EEU602	Power System Analysis - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU603	Control System - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU604	Electrical Machine Design	3	---	---	3	10	15	15	60	---	---	100	3
EEU605	Operation Research Techniques	3	---	---	3	10	15	15	60	---	---	100	3
EEU606	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU607	Power System Analysis - II Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU608	Control System - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU609	Electrical Machine Design Lab	---	---	2	2					25	25	50	1
EEU610	Minor Project	----	----	2	2	---	----	---	----	25	25	50	2
EEU611	Self Study - II	---	---	----	0	---	---	---	---	25	---	25	2
EEU612	Industrial Lecture - I*	1	---	----	1	---	---	---	---	---	---	0	---
Total		16	0	10	26	50	75	75	300	150	100	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.
- 3) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II
- 4) Self study-II is based on one class test each on the basis of 20% curriculum of the courses EEU601,EEU602,EEU603,EEU604 declared by respective course coordinator at the beginning of the semester.
- 5) One faculty member shall be appointed as course coordinator for self study-II and his/her teaching work-load shall be consider 1 hr/week
- 6)Assessment of Industrial Lecture - I is scheduled in VII sem with Industrial Lecture-II

SEM VII													
EEU701	Switch Gear and Protection	3	---	---	3	10	15	15	60	---	---	100	3
EEU702	Linear & Digital Integrated Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU703	Elective - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU704	Interdisciplinary Elective	3	---	---	3	10	15	15	60	---	---	100	3
EEU705	Switch Gear and Protection Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU706	Linear & Digital Integrated Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU707	Elective –I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU708	Project Phase - I	---	---	4	4	---	---	---	---	50	--	50	2
EEU709	Seminar	---	---	2	2	---	---	---	---	50	---	50	2
EEU710	Industrial Training /Visit	---	---	---	0	---	---	---	---	50	---	50	1
EEU711	Industrial Lecture - II*	1	---	---	1	---	---	---	---	25	---	25	1
EEU712	Self Study - III	---	---	---	0	---	---	---	---	25	---	25	2
Total		13	0	12	25	40	60	60	240	250	100	750	23

NOTE:

- 1) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II
- 2) Self study - III is based on one class test each on the basis of 20% curriculum of the courses EEU701,EEU702,EEU703 declared by respective course coordinator at the beginning of the semester.
- 3) One faculty member shall be appointed as course coordinator for self study - III and his/her teaching work-load shall be consider 1 hr/week
- 4) Students of this department shall select any on Interdisciplinary Elective offered by other departments. Interdisciplinary Elective shown below will be offered to students of the other department.

SEM VIII													
EEU801	Power Systems Stability	3	---	---	3	10	15	15	60	---	---	100	3
EEU802	Electrical Drives and Control	3	---	---	3	10	15	15	60	---	---	100	3
EEU803	Elective - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU804	Elective - III	3	---	---	3	10	15	15	60	---	---	100	3
EEU805	Power Systems Stability Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU806	Electrical Drives and Control Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU807	Elective – II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU808	Project Phase - II	---	---	6	6	---	---	---	---	75	100	175	6
EEU809	Self study - IV	---	---	---	0	---	---	---	---	25	---	25	2
Total		12	0	12	24	40	60	60	240	175	175	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) Duration of ESE is 2 Hrs 30 Minutes for all courses
- 3) Self study - IV is based on one class test each on the basis of 20% curriculum of the courses ,EEU801,EEU802,EEU803,EEU804 declared by respective course coordinator at the beginning of the semester.
- 4) One faculty member shall be appointed as course coordinator for self study - IV and his/her teaching work-load shall be consider 1 hr/week

LIST OF ELECTIVES

Interdisciplinary Elective (EEU704)	Elective - I (EEU703)	Elective II (EEU803)	Elective III (EEU804)
A) Electromechanical Energy Conversion	A) Digital Signal Processing	A) Multirate DSP and Wavelet	A) HVDC and FACTS
B) Robotics and Automation	B) Advanced Microprocessor	B) High Voltage Engineering	B) High Voltage Transmission
C) Energy Efficiency in Electrical Utilities	C) Computer Methods in Power System Analysis	C) Network Synthesis	C) Power Quality & Deregulation
	D) Power System Operation and Control	D) Artificial Neural Network	D) Statistical Signal Processing

EEU 701 SWITCHGEAR AND PROTECTION

Teaching Scheme: 03 L + 00 T

Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Circuit Interruption: Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

Fuses: Types, Constructional features, operation, Characteristics and Applications

Circuit Breaker: Air break, Air blast, minimum oil-type, SF₆, Vacuum, Miniature, Earth leakage and Moulded Case – types constructional features, operation and application.

Relaying Principle: Components, Essential features, Characteristics, Terminology, CT's and PT's, Relay classification.

Electromechanical Relays: Over current, Directional, Distance and Differential – types, constructional features, operation, characteristics and application.

Protection of Transmission Lines

Relaying schemes: over current, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.

Protection of Transformers, Motors, Generators and Buses.

Modern trends in power system protection

Basic concepts, equipments, comparators, Characteristics realization – over current, directional, differential and distance relay. Introduction to numerical relay. Block Diagram of Numeric relay.

Text Book:

1. Power System Protection and Switchgear, Badri Ram and B. N. Vishwkarma, 3rd Edition Tata Mc-Graw Hill Publishing Company Limited, New Delhi. 2003.
2. Power System Protection and Switchgear, B. Ravindranath and M Chander, Wiley Eastern Ltd, New Delhi, 2006.
3. Fundamental of power system protection, Y.G. Paithankar and S. R. Bhide ,PHI publications, 2008

Reference Books:

1. Switchgear Handbook, R. T. Lythall, J and P Newness Butterworth, London. 1993.
2. Power system protection and switchgear, Bhuvanesh A Oza and Nair, Tata McGraw Hill Education private limited New Delhi.
3. Protective Relaying, A. R. Van and C Warrington , Chapman Hall, London.,2 Edition, Vol 1 and 2, 2000
4. Generation Protection and Switchgear, V. A. Slabikov, CIT Press, Coimbatore. 1998.
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU 702 LINEAR AND DIGITAL INTEGRATED CIRCUITS

Teaching Scheme: 03 L + 00 T

Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Linear Integrated circuit

Review of op-amp ; Applications of op amp as V to I converter, dc and ac voltmeter, match diode finder, LED tester, zener diode tester using V to I converter, using I to V converter, light intensity meter using I to V converter. Instrumentation amplifier, Application of instrumentation amplifier as temp controller, temperature indicator, Light intensity meter, flow measurement thermal conductivity measurement, weigh scale; phase detector voltage comparator, window detector, time marker generator, Schmitt trigger; voltage limiter; practical differentiator; practical integrator; logarithmic amplifier; analog amplifier; use of op-amp in medical electronics; electronic thermometer; simulation of inductance using op-amp; sine square and triangular waveform generator.

Timer-IC 555, monostable and astable multivibrator using IC 555; series and shunt regulated power supply, IC 723, IC 7805 etc; phase locked loop (PLL), applications of PLL, IC 565.

Digital Circuits

Combinational logic design using MSI circuit.

Introduction, Multiplexers and their use in combinational logic design, Demultiplexers / decoders and their use in combinational logic design, adders and their use as subtractors, BCD arithmetic, Arithmetic logic Unit (ALU), Digital comparators, Parity generators, code converters, priority encoder, decoder drivers for display devices.

Programmable Logic devices

Introduction, ROM as PLD, Programmable Logic Array, Programmable Array Logic, Complex Programmable Logic Devices (CPLDs), Field- Programmable Gate Array (FPGA)

Computer aided design of digital systems

Introduction, CAD concept, CAD tools, Introduction to VHDL, describing combinational circuits using VHDL, describing sequential circuits using VHDL

Text Books

1. Op-amps and Linear Integrated Circuits Technology, R.A.Gaikwad, PHI publication, 1999
2. Modern Digital Electronics, R.P. Jain, 3rd edition, Tata Mc-Graw Hill, 2005

References

1. Linear Integrated Circuits, D.Roy Chaudhari ,New Age International Publisher, 2005
2. Design of Operational Amplifier and Analog Integrated Circuits, S.Franco TMH Publication, 2002
3. Digital Electronics-Circuits and Systems, V. K. Puri, 1st edition, Tata McGraw Hill Publications, 2003
4. Digital Principles and Application, A. P. Malvino, D. P. Leach, 6th edition, Tata Mc-Graw Hill,2006.

EEU703 ELECTIVE-I
(A) DIGITAL SIGNAL PROCESSING

Teaching Scheme: 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Signals and Signal Processing : Characterization and classification of signals, Typical signal processing operations , Typical signal processing applications, Advantages of digital signal processing
Time Domain Representations of Signals and Systems: Discrete time signals, Operations on sequences, Discrete time systems, linear time invariant discrete time systems, Characterization of LTI systems.

Transform Domain Representation of Signals And Systems: The discrete time Fourier transform, The frequency response, The transfer function, Discrete Fourier series, Discrete Fourier transform, Computation of DFT, Linear convolution using DFT, The z-transform, The region of convergence of z transform

Structures for Discrete Time Systems: Block diagram and signal flow representation of constant coefficient, linear difference equation, Basic structures for IIR systems, Basic structures for FIR systems, Lattice structures, Effects of coefficient quantization, Effect of round off noise in digital filters, Zero-input limit cycles

Filter Design Techniques: Design of discrete time IIR filters from continuous time filters, Design of FIR filters by windowing, Optimum approximation of FIR filters, linear phase filters

Text Book:

1. Digital Signal processing A computer Based Approach by S.K.Mitra;
3rd Edition; McGraw Hill, 2007

Reference Books:

1. Digital Signal Processing by Proakis and Manolakis; 3rd Edition ;
Pearson Education 2006
2. Digital Signal Processing by Ashok Ambardar Thomson Learning 2011
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EEU703 ELECTIVE-I
(B) ADVANCED MICROPROCESSOR

Teaching Scheme: 03 L + 00 T

Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

8086 Microprocessor Architecture - Segmented Memory - Addressing Modes - Instruction Set - 8086 Assembly Language Programming - 8087 Numerical Data Processor Architectural details - Data types - Floating point Operations - 8087 Instructions.

Architectural details of 80386 Microprocessor - Special registers - Memory management - Operation in protected mode and virtual 80386 mode - Memory paging mechanism - Special instructions of 80386 - Architectural details of 80486 - Special registers - Additional instructions - Comparison of 80386 and 80486 processors.

Introduction to Pentium Processor - Architectural features - Comparison with the workstations - Branch prediction logic - cache structure. - Special Pentium Registers. Memory management - virtual mode of operation - Comparison with the previous processors. Features of Pentium-II, Pentium-III and Pentium Pro-processors.

RISC Microprocessors – RISC Vs CISC – RISC Properties – DEC Alpha AXP Architecture - Power PC – Architecture - Programming Model – Data Types – Addressing Modes – Instruction Set. Sun SPARC – Architecture – Data Types – Instruction Sets - Features of MIPS, AMD Microprocessors

Text Books:

1. Barry B Brey “Intel Microprocessors : 8086/88, 80186/188, 80286, 80386, 80486, Pentium, Pentium – II, Pentium – III and Pentium – IV, Architecture, Programming & Interfacing”, Pearson Education, 2003

Reference Books:

1. Badri Ram, “Advanced Microprocessors and Interfacing”, Tata McGraw Hill.
2. A.K. Ray & K.M. Bhurchandi, “Advanced Microprocessors & Peripherals, Architecture,

EEU703 ELECTIVE-I

(C) COMPUTER METHODS IN POWER SYSTEM ANALYSIS

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Graph of a power system, incidence matrices, primitive network, formation of network matrices by singular transformation

Representation of power system for computerized analysis: mathematical model of synchronous generator for steady state and transient analysis, transformer with tap changer, phase shifter, transmission line, and loads.

Algorithm for formation of bus impedance matrix for systems without mutual coupling, modification for changes in the network. Incidence and network matrices for three phase network, transformation matrices, algorithm for formation of bus impedance matrix for three phase networks.

Short Circuit Studies: Symmetrical component, Thevenin's theorem and short circuit analysis of multi-node power systems using bus impedance matrix. Short circuit calculations for balanced and unbalanced faults.

Load Flow Analysis: Types of buses, load flow equations, power flow solution through GS and NR methods, decoupled and fast decoupled methods, sparsity.

Transient Stability Analysis: Including synchronous machines, system network and loads, solution of swing equation by Euler's, Euler's modified and RK methods

Economic Load Scheduling: Unit commitment, transmission loss, load scheduling considering transmission losses, unit commitment by dynamic programming method.

Text Books

1. Computer Methods in Power System Analysis, G.W. Stagg & A.H.El-Abiad, McGraw Hill 2003
2. Power System Analysis, Hadi Saadat, TMH 2004

References

1. Modern Power System Analysis (3rd Edn.), Kothari & Nagrath TMH.2004
2. Power System Analysis and Design, B. R. Gupta,
3. Computer Techniques in Power System Analysis, M. A.Pai, TMH
4. Advanced Power System Analysis and Dynamics, L. P. Singh WEL 2002.
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU703 ELECTIVE-I

(D) POWER SYSTEM OPERATION AND CONTROL

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Introduction-System load – variation, load characteristics – load curves and load-duration curves, load factor, diversity factor, load forecasting, simple techniques of forecasting, basics of power system operation and control, reserve margin, load-frequency control, voltage control, Hydrothermal coordination.

Economic Operation and Unit Commitment problem – : Meaning of optimum scheduling, UCP and LSP, Input – Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost, Methods of obtaining incremental fuel costs, Conditions for incremental loading, Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Transmission loss as a function of plant generation: Calculation of loss co-efficient (Two plant system), Incremental transmission loss, Optimum scheduling of generation between different plants including transmission loss, Concept and significance of penalty factor, Automatic load dispatch: Operation and Functions.

Generator Control Loops: Concept of real and reactive power, Effect of real and reactive power on system parameters, Philosophy of real and reactive power control, Basic generator control loops.

Automatic Voltage Regulator (AVR): Functions of AVR, Types of Exciter, Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Automatic Load Frequency Control: Automatic generation control (AGC), Speed governing system, Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load, Transfer function representation of an isolated generator, Static performance of speed governor , Closing of ALFC loop.

Control Area: Meaning, Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results, Secondary ALFC loop, Integral Control, Pool operation, Tie-line Modeling, Two area system – Dynamic response, Tie-line bias control.

Text Books

1. Electric Energy Systems Theory: An Introduction, O. L. Elgerd, Second edition, McGraw-Hill Book Comp. N.Y. 1987.
2. Power System Analysis, Hadi Saadat, WCB/McGraw-Hill International Edition 1999

References

1. Modern Power System Analysis, I. J. Nagrath, D. P. Kothari, Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi. 2000
2. Economic Operation of Power System, L. K. Kirchamayar Wiley Eastern Pvt. Ltd., New Delhi 2007
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EEU 704 INTERDISCIPLINARY ELECTIVE
(A) ELECTROMECHANICAL ENERGY CONVERSION

Teaching Scheme : 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Electric and Magnetic Field Calculations: Magnetic circuit calculations for devices and machines, Theory of electrostatic and magnetic fields, Fundamental equations, Fields of simple geometries.

Electromechanical Energy Conversion: Energy storage in singly and multiply-excited systems, Mechanical force and stored energy, Electromechanical transducers and their analysis, Reluctance type devices, Energy dissipation- resistance, eddy current, hysteresis and dielectric loss, Lagrange's equation.

Induced Voltage, Armature Reaction and Torque: Induced voltage in windings of ac and dc machines, Armature reaction- MMF of a single coil and uniformly distributed conductors, Rotating magnetic fields in ac machines, Torque in dc and three-phase ac machine, Torque of mutually coupled coils.

Dynamics of Electric Machines: Dynamics of dc machines, Dynamic response of first and second order linear systems, Voltage regulation of separately-excited dc generator, Speed control of separately-excited dc motor, Synchronous-machine dynamics, Parallel operation and synchronizing of alternators.

TEXT BOOKS

1. Electro-mechanical energy conversion with dynamics of machines, Rakosh Das Begamudre, Second Edition, New Edge International Publishers, New Delhi.-2008
2. Electric Machines, I J Nagrath and D P Kothari, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 2003

REFERENCE BOOKS

1. Principles of Electro-mechanical energy conversion, Del Toro V, Prentice-Hall, Englewood Cliffs, N J.
2. Electric Machinery, Fitzgerald A E and Kingslley C, 1st to 4th Editions, McGraw-Hill Book Company.
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

**EEU 704 INTERDISCIPLINARY ELECTIVE
(B) ROBOTICS AND AUTOMATION**

Teaching Scheme : 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Introduction: Robot definition, Robot classification, Robotic system components. Notations, Position definitions, Coordinate frames, Different orientation descriptions, Free vectors, Translations, rotations and relative motion, Homogeneous transformations, Spatial Descriptions and Transformations.

Manipulator Kinematics and Mechanics of Robot Motion: Link coordinate frames, DenavitHartenberg convention, Joint and end-effectors, Cartesian space, Forward kinematics transformations of position, Inverse kinematics of position, Translational and rotational velocities, Velocity Transformations. Manipulator Jacobian. Forward and inverse kinematics of velocity, Singularities of robot motion, Static Forces, Transformations of velocities and static forces, Joint and End Effectors force/torque transformations.

Manipulator Dynamics: Trajectory Planning, Control. Lagrangian formulation, Model properties, Newton-Euler equations of motion, Joint-based motion planning, Cartesian-based path planning. Independent joint control, Feed-forward control, Inverse dynamics control, Robot controller architectures, Implementation problems.

Automated Manufacturing Systems: Introduction, Manufacturing systems, Performance measure, Computer controlled machines, Material handling systems, Plant layout. Flexible manufacturing system, Computer control system.

Texts Books

1. Introduction to Robotics: Machines and Control, John J. Craig, 3rd Edition, Prentice Hall -2004

References

1. Modeling Identification & control of Robot , W.Khalil & E.Dombare , McGraw Hill -2005
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EEU704 INTERDISCIPLINARY ELECTIVE

(C) ENERGY EFFICIENCY IN ELECTRICAL UTILITIES

Teaching Scheme: 03 L + 00 T Total 03

Credit: 03

Marking Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Electrical systems:

Introduction to Electrical energy systems, Tariff and economic considerations, T & D losses, Electrical load and various factors, Power factor and its introductory improvement techniques, Energy Efficient Technologies in Electrical Systems

Electric Motors and Drives:

Energy Efficient Motors, Factors affecting Energy efficiency of a motor

Introduction to power electronic controllers, soft starters and block diagrams of stator voltage and stator frequency controlled three phase induction motor drives, block diagrams of controlled rectifier and chopper fed dc shunt motor

Fans and Blowers:

Types, efficient system operation, Capacity selections, Performance assessment of fans and blowers, Energy conservation opportunities

Pumping systems:

Types, Performance evaluation, efficient system operation, Energy conservation opportunities in pumping systems

Lighting systems:

Basic terms of lighting systems, recommended illumination level, Methodology of lighting systems, energy efficiency study, Energy conservation opportunities

DG Set and UPS systems:

Introduction, Selection and capacity factor, Operational parameters, Performance assessment of DG Systems, Energy conservation opportunities

Block diagram and working of UPS

Energy Efficiency in Renewable Energy Systems:

Energy efficiency in solar and wind energy systems

Text Books

- 1) Energy Efficiency in Electrical Utilities, BEE Guide Books, 2010
- 2) Utilization of Electrical Energy, E.O. Taylor, Orient Blackswan Publishers Pvt. Ltd., New-Delhi, Reprint 2008

References

- 1) Handbook of Energy Engineering, Albert Thumann, D. Paul Mehta, Sixth Edition, The Fairmount Press Inc., 2008
- 2) TEDDY Year Book Published by Tata Energy Research Institute (TERI)

EEU705 SWITCH GEAR AND PROTECTION LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course EEU701) from the list or otherwise.

Minimum eight experiments should be performed.

- 1) Characteristics of Miniature circuit breaker
- 2) Characteristics of rewritable fuse
- 3) Operation of Parallel feeder
- 4) Combined protection for generator transformer unit
- 5) Various circuit breakers
- 6) Over current relay characteristics
- 7) Earth fault relay
- 8) Generalized protection scheme

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.

EEU706 LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

Minimum Ten experiments based on syllabus of EEU 702 Linear & Digital Integrated circuits. Representative list of experiments is as follows.

1. Inverting amplifier using IC 741 and its frequency response.
2. Non-inverting amplifier using IC 741 and its frequency response.
3. Summing amplifier- to build summing amplifier in inverting and non-inverting mode.
4. Measurement of Op-amp parameters: Input offset voltage, input bias current. Input offset current, CMRR.
5. Measurement of slew rate.
6. To build voltage comparator and to generate the waveforms on CRO.
7. Voltage limiter-to build Voltage limiter and to generate the output waveforms.
8. Differentiator -to build and to generate the output waveforms for various values of R and C.
9. Integrator -to build and to generate the output waveforms for various values of R and C.
10. Precision rectifiers-to build precision rectifiers and to generate the output waveforms
11. To verify different logic gates.
12. Realization of half adder using gates.
13. Realization of half subtractor using gates.
14. Implementation of full Adder circuit using gates.
15. To study Flip-Flops.
16. To Study counters.

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

EEU707 ELECTIVE I LAB

(A) DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme: 02 P Total: 02

Evaluation Scheme: 25 ICA + 25 ESE

Duration of ESE: 3 Hrs

Credit: 01

Total Marks: 50

Representative list of experiments is as follows. Minimum 10 experiments to be performed.

1. To study basic discrete-time signals and operations.
2. To learn how to represent and implement discrete-time signals using MATLAB
3. To study convolution and correlation of discrete-time signals
4. To learn how to implement the two operations using MATLAB
5. To study the sampling principle and the effect of sampling on the frequency-domain quantities
6. To study and investigate the Discrete Fourier Transform
7. To learn how to implement the operation using MATLAB
8. To learn how to analyze discrete-time signal using DFT
9. To learn how to synthesize discrete-time signal using IDFT
10. To study and investigate the Fast Fourier Transform algorithm.
11. To learn how to analyze discrete-time signal using FFT
12. To learn how to synthesize discrete-time signal using IFFT
13. To determine specifications needed for FIR filter design.
14. To learn how to design the FIR filters using window techniques.
15. To learn how to implement the designed FIR filter by MATLAB.
16. To determine specifications needed for IIR filter design.
17. To learn how to design and implement IIR filters using MATLAB.

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

EEU707 ELECTIVE I LAB

(B) ADVANCED MICROPROCESSOR LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

Minimum Ten program must be entered and executed covering the Entire Syllabus of EEU703, (Advanced Microprocessor)

LIST OF MICROPROCESSOR LAB EXPERIMENTS

1. Write an ALP to transfer a block of N word from source block to the destination block, without overlap.
2. Write an ALP to transfer a block of N word from source block to the destination block, with overlap.
3. Write an ALP to interchange a block of N-bytes / words.
4. Write an ALP to add the two given N-bit multi precision numbers $\{N \geq 32 \text{ bits}\}$.
5. Write an ALP to multiply two 32-bits unsigned hexadecimal numbers.
6. Write an ALP to divide an unsigned N-bit hexadecimal number by an unsigned Hexadecimal byte (N to be specified > 16bits).
7. Write an ALP to check whether the given 8-bit data is a. Positive or Negative. b. Odd or even. c. Find the logical 1's and 0's in the given data.
8. Write an ALP to find the HCF of two 16-bit unsigned numbers.
9. Write an ALP to find the LCM of two 16-bit unsigned integers.
10. Write an ALP to find the factorial of a number N ($N \leq 9$).
11. Write an ALP to convert 16-bit BCD number to its Hexadecimal equivalent.
12. Write an ALP to convert a given 16-bit Hexadecimal number to its BCDequivalent. Display the result.
13. Write an ALP to find the square and cube of a given 32-bit hexadecimal number.
14. Write an ALP to add two strings of ASCII digits. (Length to be specified).
15. Write an ALP to subtract two strings of ASCII digits (Length to be specified).
16. Write an ALP to multiply a string of ASCII digits by a single ASCII digit.
17. Write an ALP to divide a string of ASCII digits by a single ASCII digit.
18. Write an ALP to transfer the given string data to the destination using stringprimitive instructions.
19. Write an ALP to reverse a string and check whether the given string is apalindrome or not.
20. Write an ALP to sort the given set of 16-bit unsigned integers inascending/descending order using Bubble sort algorithm.
22. Write an ALP to sort the given set of 16-bit unsigned integers inascending/descending order using Insertion sort algorithm

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

EEU707 ELECTIVE I LAB

(C) COMPUTER METHODS IN POWER SYSTEM ANALYSIS LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU703 Elective I (C) (Computer Methods in Power System Analysis) using MATLAB/ SIMULINK/ Power world Simulator. Representative list is as follows –

01. To Form Y_{bus} matrix using singular transformation.
02. To Form Y_{br} matrix using singular transformation.
03. To Form Z_{loop} matrix using singular transformation.
04. To Form Z_{bus} matrix using step-by-step method.
05. To Form Y_{bus} matrix using step-by-step method.
06. To perform load flow analysis using Gauss-Seidel method.
07. To perform load flow analysis using Newton-Raphson method.
08. To perform short circuit analysis for a particular type of fault (LG / LL / LLG / LLL / LLLG)
09. Solution of swing equation by Euler's method.
10. Solution of swing equation by Euler's modified method.
11. Solution of swing equation by RK2 method.
12. Unit commitment using equal incremental cost method.
13. Unit commitment using dynamic programming method.
14. Load scheduling considering transmission losses.

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

EEU707 ELECTIVE I LAB

(D) POWER SYSTEM OPERATION AND CONTROL LAB

Teaching Scheme: 02 P Total: 02

Evaluation Scheme: 25 ICA + 25 ESE

Duration of ESE: 3 Hrs

Credit: 01

Total Marks: 50

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU703(D) Elective I Power System Operation and Control using MATLAB/ SIMULINK / Power world Simulator. Representative list is as follows –

1. Unit commitment using equal incremental cost method.
2. Unit commitment using dynamic programming method.
3. Load scheduling considering transmission losses.
4. Visit to a Load Dispatch centre
5. Model of speed governing system
- 6 .Generator Control Loops
7. Automatic Voltage Control
8. Static performance of speed governor
9. Dynamic response of speed governor
10. Automatic Load Frequency Control

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.

EEU708 PROJECT PHASE - I

Teaching Scheme : 04 P Total: 04
Evaluation Scheme: 50 ICA

Credit: 02
Total Marks: 50

- 1 In general, a group of 3-6 students should be allowed to complete the project on Approved topic.
- 2 Preferably more than 25 % projects shall be Industry / Research based / oriented.
- 3 Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.
- 4 Students should finalize the topic for the project after literature survey in consultation with the Guide.
- 5 The **Synopsis/Abstract** on the selected topic should be submitted to the H.O.D. for approval.
- 6 On approval of the topic, students should initiate the topic based work.
- 7 Approximately more than 30% work(of the total quantum) should be completed by the end of VII semester.
- 8 At the end of semester, each batch should submit the progress report in following format:
Title
Introduction
Concept
Work completed
Work to be completed
References
- 9 For uniform and continuous evaluation, the Evaluation Committee comprising of the Guide, Project Course Coordinator and Expert appointed by the Program Head will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted by the panel of examiners.

EEU709 SEMINAR

Teaching Scheme : 02 P Total: 02
Evaluation Scheme : 50 ICA

Credit: 02
Total Marks: 50

1. Student shall select a topic for seminar which is **not covered in curriculum**.
2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head.
3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:
Introduction
Literature Survey
Concept
Functional and Technical Details
Future scope
Applications
Comparison with similar topics / methods
References
5. Student shall deliver a seminar based on submitted report. The presentation and oral examination on selected seminar topic shall be assessed by panel of examiners

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Seminar Topic and the knowledge acquired. The seminar shall be assessed by the examiner panel consisting of Project Guide, Course Coordinator Seminar and Expert appointed by Program Head.

EEU710 INDUSTRIAL TRAINING/VISIT

Teaching Scheme: 00
Evaluation Scheme: 50 ICA

Total: 00 Credits: 01
Total Marks: 50

Industrial Training shall have an option of Industrial Visit.

Industrial Training: List of renowned industries shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal and with the consultation of Industry personnel, 02 weeks trainings shall be arranged during the vacations (after the VI semester). The students may be permitted to undergo the trainings of 02 weeks as per their choices for which all the official formalities will be completed by the students under the guidance of course coordinator. The students shall submit the report based on the Industrial training to the course coordinator which will be evaluated during the VII semester

Industrial Visit: An Industry Visits to minimum three industries shall be arranged for the students unable to complete the Industrial Training. The visit shall be arranged preferably during the vacation period. However in non-availability of permission for the visit during vacation period, same may be

arranged during the regular VII semester. The students will be required to submit the report based on the Industrial Visit which will be evaluated by the course coordinator

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the training/visits and knowledge / skill acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

EEU711 INDUSTRIAL LECTURE-II

Teaching Scheme: 01 L

Total: 01 Credits: 01

Evaluation Scheme: 25 ICA

Total Marks: 25

List of renowned persons from industry shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal, Minimum twelve Industrial lectures shall be arranged, preferably once a week, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors covering the various aspects.

The assignments based on the Industry Lecture-I and Industry Lecture-II will be evaluated during VII semester

Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.

Students shall submit the report based on lectures.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the lectures and knowledge acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

EEU712 SELF STUDY-III

Teaching Scheme: 00 P Total: 00

Credit: 02

Evaluation Scheme: 25 TA

Total Marks: 25

1] Self study - III is based on one class test each on the basis of 20% curriculum of the courses EEU701,EEU702,EEU703 declared by respective course coordinator at the beginning of the semester

2] One faculty member shall be appointed as course coordinator for Self Study - III and his/her work load shall be considered as 1 hr/week.

EEU801 POWER SYSTEMS STABILITY

Teaching Scheme: 03 L + 00 T

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE: 2 Hrs.30 min

Total: 03 Credits: 03

Total Marks: 100

Basics of Power System Stability: Concept of stability, types of stability, modeling of power system components for stability studies, power system dynamics, swing equation, factors affecting stability and recent trends for improving stability

Small Disturbance Stability: Steady state stability of two-machine system, power angle curve, stability criterion, definition and computation of SSSL by analytical and graphical methods, effect of inertia, saliency, saturation, governor action and SCR on SSSL

Large disturbance Stability: Single machine infinite bus (SMIB) system, classical model, equal area criteria technique and its applications to various types of disturbances, point by point method for solving swing equation

Excitation System: Effect of excitation system on generator power limit, various types of excitation systems, transformation model of excitation system

Text Books

1. Power System Analysis, Hadi Sadat, Tata McGraw Hill, 2005
2. Modern Power System Analysis, Nagrath and Kothari, McGraw Hill, 2005

References

1. Power System stability and Control, P.Kundur, McGraw Hill, New York, 2007
2. Power System Stability, E.W.Kimbark, Vol 1 and 3 , Dover Publications 1999
2. Power System Dynamics, Stability and Control, K.R.Padiyar Interline Publishers, Ban galore, 2007
3. Power System Control and Stability, P.M Anderson and A.A. Fouad, McGraw Hill, 2004
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU802 ELECTRICAL DRIVES AND CONTROL

Teaching Scheme: 03 L + 00 T

Total: 03 Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min

Introduction to Electrical Drives: Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

Starting and Braking of Electrical Drives: Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, braking of d c and induction motors.

DC Drives: Single phase half, full and dual converter based d c drives - Circuit configurations, input/output waveforms, Calculation of torque, speed, power factor, firing angle etc. Torque-Speed characteristics. DC Chopper based d c drives - Circuit configurations, input-output waveforms, Calculation of torque, speed, duty cycle etc. Torque-Speed characteristics.

Induction Motor Drives: Scalar control of induction motor – stator voltage and stator frequency control using stator voltage controllers and inverters – circuit configurations, calculation of current, torque, speed etc. Torque-Speed characteristics. Slip power recovery schemes – rotor chopper / inverter control of induction motor - Circuit configurations and theoretical concepts only.

Industrial Applications: Electrical drives system for rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

Text Books

1. Fundamentals of Electrical Drives, G. K. Dubey, Narosa Publishing House, 2005
2. Electric Drives-Concepts and Applications, V.Subrahmanyam TMH Pub, 2004
3. A first course on Electrical Drives, S.K.Pillely Wiley Eastern Pub, 2002
4. Electric Drives, De and Sen PHI Pub, 1999

References

1. Thyristor DC Drives” P.C.Sen John Wiley & Sons, 1981.
2. Power Electronic Control of AC Motors”, JMD Murphy & FG Turnbull, Pergamon Press, 1988.
3. Power Semiconductor Controlled Drives”, G.K. Dubey PH Int., 1989.
4. Power Semiconductor Drives” Deewan, Straughan & Slemon John Wiley & Sons.
- 5 <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU803 ELECTIVE-II

(A) MULTIRATE DSP AND WAVELET

Teaching Scheme: 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Beginning with some practical situations, which call for multi-resolution / multi-scale analysis - and how time-frequency analysis and wavelets arise from them. Examples: Image Compression, Wideband Correlation Processing, Magnetic Resonance Imaging, Digital Communication.

Piecewise constant approximation: Haar wavelet, Building up the concept of dyadic Multi-resolution Analysis (MRA), Relating dyadic MRA to filter banks, review of discrete signal processing. Elements of multi-rate systems and two-band filter bank design for dyadic wavelets.

Families of wavelets: Orthogonal and biorthogonal wavelets. Daubechies' family of wavelets in detail. Vanishing moments and regularity. Conjugate Quadrature Filter Banks (CQF) and their design. Dyadic MRA more formally. Data compression - fingerprint compression standards, JPEG-2000 standards.

The Uncertainty Principle and its implications: the fundamental issue - the problem and the challenge that nature imposes. The importance of the Gaussian functions: the Gabor Transform and its generalization; time, frequency and scale - their interplay. The Continuous Wavelet Transform (CWT). Condition of admissibility and its implications. Application of the CWT in wideband correlation processing.

DWT: Discretization in steps. Discretization of scale - generalized filter bank. Discretization of translation - generalized output sampling. Discretization of time/ space (independent variable) - sampled inputs.

Variants of the wavelet transform and its implementational structures: An exploration of applications (this will be a joint effort between the instructor and the class). Examples: Transient analysis; singularity detection; Efficient signal design and realization: wavelet based modulation and demodulation; Applications in mathematical approximation; Applications to the solution of some differential equations; Applications in computer graphics and computer vision; Relation to the ideas of fractals and fractal phenomena.

Text Book:

1. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Pearson Education, Low Price Edition, ISBN 81 – 7758 – 942 – 3.

Reference Books:

1. Howard L. Resnikoff, Raymond O. Wells, "Wavelet Analysis: The Scalable Structure of Information", Springer, 1998: available in Indian Edition.
2. Raghuvver M. Rao, Ajit S. Bopardikar, "Wavelet Transforms: Introduction
3. K. P. Soman, K. I. Ramachandran, "Insight into Wavelets - From Theory to Practice", Prentice Hall of India, Eastern Economy Edition, ISBN Number 81-203-2650-4.
4. Michael W. Frazier, "An Introduction to Wavelets through Linear Algebra", Springer, ISBN 3-540-780-75-0, c 1999,
5. www.ocw.mit.edu

EEU803 ELECTIVE-II

(B) HIGH VOLTAGE ENGINEERING

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Mechanism Of Breakdown In Gases: Classification of insulating materials. Gases as insulating media, Ionization & decay process, breakdown in gases, Townsend's law. The streamer mechanism of spark Paschen's law, corona discharge, electronegative gases

Breakdown In Liquid And Solid Dielectrics : Breakdown in pure and commercial liquids, Solid Dielectrics and composite dielectrics, High Voltage bushings, Guarding, Shielding, Field Plotting.

Lightning and Switching over Voltages and Protection: Lightning strokes to lines and towers, mechanism & characteristics. Protection of transmission lines from lightning, Lightning Arrestors. Insulation to co-ordination of HV and EHV transmission line, Power system and substation.

High Voltage and Current Generation: Generation of High D.C, A.C. and Impulse voltages, Standard impulse wave shapes, Switching Surges , High Impulse Generator

High Voltage And Current Measurement: Peak voltage, Impulse voltage and High Direct current Measurement methods, Non-destructive measurement and testing, High Voltage dielectrics Loss and capacitance measurement, Radio Frequency and partial discharge measurement.

High Voltage Testing: Basic Terminology, Testing – Insulation, Bushings, Cables, Transformers, Surge Diverters and Isolators, Electric Shock and threshold current

Text Book

1. High Voltage Engineering, Naidu M.S. and Kamaraju V Tata McGraw Hill Pub. Co. New Delhi Third Edition

References

1. High Voltage Engineering, E. Kuffel and W.S. Zaengle, Pergamon Press
2. EHV AC Transmission Engineering, Rokosh Das Begamudre, Wiley Eastern Ltd. New Delhi.
3. High Voltage Engineering, D.V.Razevig, Khanna Pub. New Delhi
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU803 ELECTIVE-II

(C) NETWORK SYNTHESIS

Teaching Scheme: 03 L + 00 T Total: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Duration of ESE: 2 Hrs.30 min.

Credits: 03

Total Marks: 100

Synthesis of one port network: Introduction, Hurwitz polynomial, Routh's criterion, positive real function, Frequency response of reactive one-ports, synthesis of reactive one-ports by Foster's and Cauer method, synthesis of R-L network by Foster's and Cauer method, synthesis of R-C network by Foster's and Cauer method.

Passive Filters: Introduction, classification of filter networks, characteristic impedance in the pass and stop bands, constant-K- low pass, high pass, band pass and band stop filters, principles of m-derived filters, the m-derived T and π sections, m-derived- low pass, high pass and band pass filters, terminated m-derived half sections, impedance matching of filters, design of composite filters.

Attenuators: Introduction, Symmetrical attenuators – T type, π type, bridged-T and lattice attenuators, Asymmetrical attenuators – T type, π type, L type attenuators.

Equalizers: Introduction, Inverse network, series equalizer, full series equalizer, shunt equalizer, constant resistance equalizer, bridge T-attenuation equalizer, lattice attenuation equalizer, lattice phase equalizer.

Active filters: Introduction, Filter function definitions, second order Sallen-key filters – active low pass, active high pass and active band pass filters, cascading of active filters, Butterworth filters – first order low pass, second order low pass, second order band pass and high pass filters, Chebyshev filters, switched capacitor filters – resistance simulation, realization of integrator, realization of gain stages, realization of one pole section.

Digital Filters: Digital filter as a system, digital filter networks, discrete time elementary functions, realization of digital filters – direct realization, direct canonic realization, cascade realization, parallel realization, ladder realization, discrete Fourier transform.

Text Books

1. An Introduction to Modern Network Synthesis, M. E. Van Valkenberg
2. Circuits and Networks – Analysis and Synthesis, A. Sudhakar & S. S. Palli (4th Edn.), TMH 2011.

References

1. Engineering Network Analysis and Filter Design, G. G. Bhise, P. R. Chadha & D. G. Kulshreshtha, Umesh Publications 2004.
2. Circuit Theory – Analysis and Synthesis, A. Chakrabarti, Dhanpatrai & Co. 2001.
3. Networks and Systems (2nd Edn.), D. Roy Choudhary, New Age International Publishers, 2010

EEU803 ELECTIVE-II

(D) ARTIFICIAL NEURAL NETWORK

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Introduction: Introduction to Artificial Intelligence, Artificial Neural Network (ANN), Characteristics of ANN

Biological neurons: Function of single biological neuron, Comparison of brain and computer, Comparison between Artificial and Biological neural network.

Basic terminology related to artificial neuron, Basic building blocks of ANN. Network architecture, setting of weights, Activation functions.

Fundamental Models of ANNs and Learning Processes: McCulloch Pitt's neuron model, Hebb net. Concept of Learning with a Teacher, Learning without a Teacher, Different Learning rules such as Hebbian learning rule, Perceptron learning rule, Delta and extended delta learning rule, Competitive learning rule, outstar learning rule, Boltzman learning rule. Concept of Linear separability

Single Layer Network and Multi-layer Network : Single Layer Perceptron: architecture – training algorithm, Application Procedure, different performance indices, different training stopping conditions and their limitations, learning curves.

Adaline and Medaline Networks: Architecture, Training and Application Algorithms

Back Propagation Network: Architecture, Back propagation Learning algorithm, Selection of parameters, Concept of learning rate, momentum coefficient, Local and global minima, Advantages and disadvantages of BPN.

Radial Basis Function Network: Architecture, Training algorithm

Self Organizing Feature Map: Concept of clustering, Concept of winner unit, methods for determining the winner unit, Kohonen self organizing Feature Map (SOFM).

Applications of ANN: Applications of ANN in bioinformatics, Forecasting (Regression), Pattern recognition (Classification)

Text Books

1. Introduction to Neural Network using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, Tata McGraw-Hill, 2009
2. Neural Networks: A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education 2007

References

1. Understanding Neural Networks and Fuzzy Logic – Basic Concepts and Applications, S. V. Kartalopoulos, PHI, 2005
2. Introduction to Neural Network, Anderson J.A., MIT press, Cambridge 2006
3. Neural Network, A classroom Approach, Satish Kumar, McGraw Hill, 2008
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU804 ELECTIVE-III

(A) HVDC AND FACTS

Teaching Scheme: 03 L + 00 T Total: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Duration of ESE: 2 Hrs.30 min.

Credits: 03

Total Marks: 100

DC Power Transmission Technology: Introduction, comparison of AC & DC Transmission, application of DC transmission, Description of DC transmission systems, planning & modern trends.

Analysis of HVDC Converters :3-pulse, 6-pulse,12-pulse converters , converters station and terminal equipment , commutation process, rectifier & inverter operation, equivalent circuit for converters , simplified analysis of Graetz circuit.

Control of Converters and HVDC System Control: Firing angle control, Current and extinction angle control, starting and stopping of DC link, power control, higher level Controllers, Converter faults and protection: Introduction, Converter faults, protection against over current, over voltage in a converter station, surge arrestors. Smoothing reactor.

Multi Terminal DC Systems: Potential applications of MTDC systems, types of system, operation & control and protection of MTDC systems. Parallel operation of HVDC

Flexible AC Transmission Systems (FACTS): Steady state and dynamics problems in AC systems, Introduction of Flexible AC transmission systems (FACTS) Necessity & objectives of FACTS,

Basic Types of FACTS Controller: Description of static var compensation (SVC), Thyristor controlled series compensation (TCSC), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPSC)

Text Books

1. HVDC Transmission, Padiyar K.R, Wiely Eastern Ltd; New Delhi
2. Understanding FACTS: Concepts and Technology of flexible AC transmission system, Hingorani N. G. & Gyugyi L., IEEE press 2000.

References

1. Direct Current Transmission, Kimbark E.W., John Wiley & Sons,1999
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EEU804 ELECTIVE-III

(B) HIGH VOLTAGE TRANSMISSION

Teaching Scheme: 03 L + 00 T Total 03

Credit : 03

Marking Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks:100

Duration of ESE: 2 Hrs.30 min.

Extra high voltage AC Transmission: Introduction to EHV-AC transmission, transmission line trends & preliminary aspects, standard transmission voltages-power handling capacities and line losses-mechanical aspects.

Electrostatic field of EHV lines, electric shock & threshold currents, capacitance of long object, Effect of Electrostatic field on Human, Animal.

Over voltages in EHV system: origin & causes, over voltage caused by switching operations, over voltage caused by interruption of low inductive current, over voltage caused by interruption of capacitive currents, ferro-resonance overvoltage Power frequency voltage control , shunt & series compensation .

Lightning: Lightning strokes, Lightning stroke to tower and midspan, Insulation coordination based on lightning.

High Voltage DC Transmission: Introduction to HVDC, Comparison of AC-DC Transmission, Types of HVDC Systems, limitation of HVDC Transmission, planning & modern trends,

Converters Station and Terminal Equipment: Analysis of HVDC Converters: 3-pulse, 6-pulse, commutation process, rectifier & inverter operation, Ground return, Circuit breaking

Converter faults and protection: Introduction, Converter faults, protection against over current ,over voltage in a converter station, surge arrestors. Smoothing reactor, Harmonics and filters

Parallel operation of HVDC and HVAC.

TEXT BOOKS

1. “Extra High Voltage AC Transmission Engineering”, Rakosh Das Begamudre ,New Age International(P) Ltd
2. “ HVDC Transmission” Wiely Eastern Ltd;” K.R.Padiyar ,New Delhi
3. “HVDC Transmission”, S.Kamakshaiah,V.Kamaraju, TMH,2011

REFERENCE BOOKS

- 1 “AC-DC Power System Analysis”, Arrillaga, IEE London, 1998.
- 2 “Direct Current Transmission”, Kimbark E.W, John Wiley & sons
- 3 www.nptel.iitm.ac.in
- 4 www.ocw.mit.edu

EEU804 ELECTIVE-III

(C) POWER QUALITY AND DEREGULATION

Teaching Scheme: 03 L + 00 T

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE: 2 Hrs.30 min

Total: 03 Credits: 03

Total Marks: 100

Basic Concepts of Power Quality: Power quality problems in distribution systems, definitions, power quality standards, Harmonics, Harmonic creating loads & its modeling

Mitigation of Power Quality Problems: Harmonics propagation, series and parallel resonance, harmonic power flow, mitigation of harmonics, filters, active filters, shunt and series hybrid filters, voltage sag and swells, voltage flicker, power electronics conditioners

Fundamentals of Restructured System: History of power system restructuring, concept of power system deregulation, regulation vs. deregulation, entities in deregulated system, Indian scenario

Models of Restructuring: PoolCo and bilateral contractual models & power exchange, ISO based markets models, market architecture, day ahead and hour ahead markets.

Transmission Open Access Issues: Available Transfer Capability (ATC) - definition and methods of determination, transmission network congestion, congestion management techniques

Text Books:

1. Electrical Power Systems Quality, Dugan Roger, McGraw-Hill Edition 2002
2. Operation of restructured power system, Bhattacharya Kankar, IEEE Publication.2001

Reference Books:

1. Power System Restructuring, Lai Lee
2. Power Quality Sags and Interruption, Mach Boolean, John Wiley
3. Power Electronics, Ned Mohan John Wiley and Sons -2003
4. Electrical Energy Utilization and Conservation, S.C. Tripathi (TMH Pub.)-2003
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU804 ELECTIVE-III

(D) STATISTICAL SIGNAL PROCESSING

Teaching Scheme: 03 L + 00 T **Total:** 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Probability: Sample space and events, Conditional, total probability, Independent event.

The Random Variable: The random variable concept, the definition of random variable, discrete and continuous random variable, mixed random variable, distribution function, density function.

Multiple Random Variables: Bivariate random variables, joint distributions and its properties, joint density and its properties, conditional distributions and density, statistical independence, central limit theorem.

Operations On Random Variables: Expectations, moments, functions that give moments, transformation of random variables, computer generation of one random variable, expected value of function of a random variable, jointly Gaussian random variable, sampling and some limit theorems.

Random Processes: Concept of random process, stationarity and independence, correlation functions, Poisson random process, Wiener process, power spectral density, relation between power spectral density and autocorrelation function.

Linear Systems with Random Inputs: Linear system response to random signals, system evaluation using white noise, discrete time systems, modeling of noise sources, some practical applications.

Text Book:

1. Probability, Random variables and random signal principles 4th edition, Peyton Z Peebles
TMH, 2001

Reference Books:

1. Probability, Random Variables, and Stochastic Processes, Papoulis, TMH, 2003
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EEU805 POWER SYSTEM STABILITY LAB

Teaching Scheme: 02 P

Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU801 POWER SYSTEM STABILITY. The Simulation is to be carried out using software like PSCAD, ETAP, MATLAB/Simulink, Power World and SimPower etc.

Representative list is as follows:

1. To find the Steady State Stability of a two machine system with and without resistance switching
2. To find the Steady State Stability of a two machine system using inductance connected in parallel with the line also without inductance and comment on stability.
3. To find the Steady State Stability of a two machine system with and without capacitance connected in parallel with the line also comment on stability.
4. To obtain the frequency of oscillations in two machine System.
5. To plot the natural response of rotor angle and frequency for two machine system.
6. Determination of maximum power without loss of synchronism using Equal area criterion.
7. To find the Transient stability limit in double circuit line when fault applied in the middle of transmission line.
8. To determine the transient stability in double circuit line when fault applied on either end.

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.

EEU806 ELECTRICAL DRIVES AND CONTROL LAB

Teaching Scheme: 02 P

Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs.

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed. (The laboratory may consist of 2-3 simulation studies based on Matlab - Simulink / PSIM / PSPICE platform and one industrial visit for study of electrical drive.)

Representative List:

1. Converter controlled d c motor.
2. Chopper controlled d c motor.
3. Stator voltage controlled induction motor.
4. Stator frequency controlled induction motor.
5. Plugging / rheostatic braking of d c motor.
6. Plugging / rheostatic braking of induction motor.
7. Study of solid state / soft starters for electrical motors.
8. Study of electrical drive in any industry. (Industrial visit)
9. Simulation of 1 / 2 / 4 quadrant Converter controlled dc drive.
10. Simulation of 1 / 2 / 4 quadrant Chopper controlled dc drive
11. Simulation of open loop / closed loop V/f control of I.M.
12. Simulation of rotor chopper control of I.M.

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

EEU807 ELECTIVE-II LAB

(A) MULTIRATE DSP AND WAVELET LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

External Total Marks: 50

Duration of ESE: 3 Hrs.

1. Use the command line functions available in the MATLAB signal processing toolbox, to simulate simple multirate DSP systems. The focus here is to be able to view in the frequency domain what is happening at each stage of a system involving upsamplers, downsamplers, and lowpass filters. All computations will be performed using MATLAB and the signal processing toolbox.
2. FIR filter design using multirate technique
3. Design of Two-Channel Orthogonal Filter bank
4. Design of Quadrature Filter Bank

EEU807 ELECTIVE-II LAB

(B) HIGH VOLTAGE ENGINEERING LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

External Total Marks: 50

Duration of ESE: 3 Hrs.

Minimum Eight Experiments must be performed covering the Entire Syllabus of EEU803 B – HIGH VOLTAGE ENGINEERING

Representative list is as follows:

1. Study of Corona
2. Determine the Breakdown voltage of paper insulator
3. Determine the Breakdown voltage of Transformer Oil
4. Generation High DC Voltage
5. Generation of High AC Voltage
6. Generation of Impulse Voltage
7. Measurement of High AC Voltage with Sphere gap and peak volt meter
8. Measurement of High DC Current
9. Measurement of High frequency and Impulse Currents
10. Measurement of DC Resistivity of conductor
11. Measurement of Dielectric Constant and Loss Factor
12. Testing of Cables
13. Testing of Insulators
14. Testing of Lightning Arrestor

EEU807 ELECTIVE-II LAB

(C) NETWORK SYNTHESIS LAB

Teaching Scheme: 02 P Total: 02
Evaluation Scheme: 25 ICA + 25 ESE
Duration of ESE: 3 Hrs.

Credit: 01
Total Marks: 50

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU803 Elective II (C) (Network Synthesis). Representative list is as follows –

01. Foster realizations (one port) of the given function.
02. Cauer realizations (one port) of the given function.
03. Design of constant k-low pass filter.
04. Design of constant k-high pass filter.
05. Design of m-derived-T-section-low pass filter.
06. Design of m-derived- π -section-high pass filter.
07. Design of full series equalizer.
08. Design of symmetrical lattice attenuator.
09. Design of fourth order Butterworth low-pass filter.
10. Design of second order Butterworth band-pass filter.
11. Impulse response and unit step response of digital filter network.

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 the experiments and may be followed by sample questions.

EEU807 ELECTIVE-II LAB

(D) ARTIFICIAL NEURAL NETWORK LAB

Teaching Scheme: 02 P Total: 02

Evaluation Scheme: 25 ICA + 25 ESE

Duration of ESE: 3 Hrs.

Credit: 01

Total Marks: 50

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU803 (D) Elective I (Artificial Neural Networks) using MATLAB/ SIMULINK. Representative list is as follows –

01. To generate a few activation functions that are used in neural networks.
02. To realize the Exclusive OR function using McCulloch-Pitts neuron.
03. To design a two input, one output perceptron to satisfy the given data.
04. To realize a Hebb net for the AND function with bipolar input and targets.
05. Pattern classification using perceptron network.
06. To realize a OR function with bipolar inputs and targets using adaline network.
07. To realize a XOR function with bipolar inputs and targets using madaline network.
08. To get XOR function (binary input and output) with momentum factor using back propagation algorithm.

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 the experiments and may be followed by sample questions.

EEU808 PROJECT PHASE - II

Teaching Scheme : 06 P Total: 06
Evaluation Scheme : 75 ICA + 100 ESE
Duration of ESE: 3 Hrs.

Credit: 06
Total Marks: 175

-
1. Project work decided in VII semester shall be continued.
 2. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
 3. Students shall submit the final project report in proper format as per guidelines given on the college website which shall include the work of both semesters.
 4. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
 5. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head.

ESE: The End Semester Examination for Project shall consists of Demonstration if any, presentation and oral examinations based on the project report.

EEU809 SELF STUDY-IV

Teaching Scheme : 00 P Total: 00
Evaluation Scheme : 25 TA

Credit: 02
Total Marks: 25

1] Self study - IV is based on one class test each on the basis of 20% curriculum of the courses EEU801,EEU802,EEU803 & EEU 804 declared by respective course coordinator at the beginning of the semester

2] One faculty member shall be appointed as course coordinator for Self Study – IV and his/ her work load shall be considered as 1 hr/week.

GOVT. COLLEGE OF ENGINEERING, AMRAVATI



CURRICULUM

B. TECH. (ELECTRICAL) VII and VIII Semester

Department of Electrical Engineering

SEM III													
Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs /week	Practical Hrs /week	Total	TA	CT1	CT2	ESE	ICA	ESE		
SHU303	Engineering Mathematics - III	3	--	---	3	10	15	15	60	---	---	100	3
ETU311	Electronic Devices and Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU301	Signals & Systems	3	1	---	4	10	15	15	60	---	---	100	4
EEU302	Network Analysis	3	1	---	4	10	15	15	60	---	---	100	4
EEU303	Electrical Measurement and Instrumentation	3	---	---	3	10	15	15	60	---	---	100	3
ETU312	Electronic Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU304	Signals & Systems Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU305	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU306	Electrical Measurement and Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
SHU305	General Proficiency - II	1	---	2	3	---	---	---	---	25	25	50	2
Total		16	2	10	28	50	75	75	300	150	100	750	23
SEM IV													
SHU401	Engineering Mathematics - IV	3	--	---	3	10	15	15	60	---	---	100	3
EEU401	Pulse & Digital Circuits	3	1	---	4	10	15	15	60	---	---	100	4
EEU402	Electrical Machines - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU403	Energy Resources & Generation	3	---	---	3	10	15	15	60	---	---	100	3
EEU404	Electromagnetic Engineering	3	1	---	4	10	15	15	60	---	---	100	4
SHU402	Engineering Mathematics Lab	1	---	2	3	---	---	---	---	25	25	50	2
EEU405	Pulse & Digital Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU406	Electrical Machines - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU407	Numerical Methods Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU408	Computational Lab - I	---	---	2	2	---	---	---	---	25	25	50	1
Total		16	2	10	28	50	75	75	300	125	125	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.

SEM V													
EEU501	Electrical Machines -II	3	---	---	3	10	15	15	60	---	---	100	3
EEU502	Power System Analysis- I	3	---	---	3	10	15	15	60	---	---	100	3
EEU503	Control System - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU504	Introduction to Microprocessor and Microcontrollers	3	---	---	3	10	15	15	60	---	---	100	3
EEU505	Industrial Organization & Management	3	---	---	3	10	15	15	60	---	---	100	3
EEU506	Electrical Machines - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU507	Power System Analysis - I Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU508	Control System - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU509	Introduction to Microprocessor and Microcontrollers Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU510	Computational Lab-II	1	---	2	3	---	---	---	---	25	25	50	2
EEU511	Self Study - I	---	---	---	0	---	---	---	---	25	---	25	2
Total		16	0	10	26	50	75	75	300	150	100	750	23

NOTE :

- 1) Self study - I is based on one class test each on the basis of 20% curriculum of the courses EEU501,EEU502,EEU503,EEU504 declared by respective course coordinator at the beginning of the semester.
- 2) One faculty member shall be appointed as course coordinator for self study - I and his/her teaching work-load shall be consider 1 hr/week

SEM VI													
EEU601	Power Electronics	3	--	---	3	10	15	15	60	---	---	100	3
EEU602	Power System Analysis - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU603	Control System - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU604	Electrical Machine Design	3	---	---	3	10	15	15	60	---	---	100	3
EEU605	Operation Research Techniques	3	---	---	3	10	15	15	60	---	---	100	3
EEU606	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU607	Power System Analysis - II Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU608	Control System - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU609	Electrical Machine Design Lab	---	---	2	2					25	25	50	1
EEU610	Minor Project	----	----	2	2	---	----	---	----	25	25	50	2
EEU611	Self Study - II	---	---	----	0	---	---	---	---	25	---	25	2
EEU612	Industrial Lecture - I*	1	---	----	1	---	---	---	---	---	---	0	---
Total		16	0	10	26	50	75	75	300	150	100	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.
- 3) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II
- 4) Self study-II is based on one class test each on the basis of 20% curriculum of the courses EEU601,EEU602,EEU603,EEU604 declared by respective course coordinator at the beginning of the semester.
- 5) One faculty member shall be appointed as course coordinator for self study-II and his/her teaching work-load shall be consider 1 hr/week
- 6)Assessment of Industrial Lecture - I is scheduled in VII sem with Industrial Lecture-II

SEM VII													
EEU701	Switch Gear and Protection	3	---	---	3	10	15	15	60	---	---	100	3
EEU702	Linear & Digital Integrated Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU703	Elective - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU704	Interdisciplinary Elective	3	---	---	3	10	15	15	60	---	---	100	3
EEU705	Switch Gear and Protection Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU706	Linear & Digital Integrated Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU707	Elective –I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU708	Project Phase - I	---	---	4	4	---	---	---	---	50	--	50	2
EEU709	Seminar	---	---	2	2	---	---	---	---	50	---	50	2
EEU710	Industrial Training /Visit	---	---	---	0	---	---	---	---	50	---	50	1
EEU711	Industrial Lecture - II*	1	---	---	1	---	---	---	---	25	---	25	1
EEU712	Self Study - III	---	---	---	0	---	---	---	---	25	---	25	2
Total		13	0	12	25	40	60	60	240	275	75	750	23

NOTE:

- 1) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II
- 2) Self study - III is based on one class test each on the basis of 20% curriculum of the courses EEU701,EEU702,EEU703 declared by respective course coordinator at the beginning of the semester.
- 3) One faculty member shall be appointed as course coordinator for self study - III and his/her teaching work-load shall be consider 1 hr/week
- 4) Students of this department shall select any on Interdisciplinary Elective offered by other departments. Interdisciplinary Elective shown below will be offered to students of the other department.

SEM VIII													
EEU801	Power Systems Stability	3	---	---	3	10	15	15	60	---	---	100	3
EEU802	Electrical Drives and Control	3	---	---	3	10	15	15	60	---	---	100	3
EEU803	Elective - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU804	Elective - III	3	---	---	3	10	15	15	60	---	---	100	3
EEU805	Power Systems Dynamics Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU806	Electrical Drives and Control Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU807	Elective – II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU808	Project Phase - II	---	---	6	6	---	---	---	---	75	100	175	6
EEU809	Self study - IV	---	---	---	0	---	---	---	---	25	---	25	2
Total		12	0	12	24	40	60	60	240	175	175	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) Duration of ESE is 2 Hrs 30 Minutes for all courses
- 3) Self study - IV is based on one class test each on the basis of 20% curriculum of the courses ,EEU801,EEU802,EEU803,EEU804 declared by respective course coordinator at the beginning of the semester.
- 4) One faculty member shall be appointed as course coordinator for self study - IV and his/her teaching work-load shall be consider 1 hr/week

LIST OF ELECTIVES

Interdisciplinary Elective (EEU704)	Elective - I (EEU703)	Elective II (EEU803)	Elective III (EEU804)
A) Electromechanical Energy Conversion	A) Digital Signal Processing	A) Multirate DSP and Wavelet	A) HVDC and FACTS
B) Robotics and Automation	B) Advanced Microprocessor	B) High Voltage Engineering	B) High Voltage Transmission
	C) Computer Methods in Power System Analysis	C) Network Synthesis	C) Power Quality & Deregulation
	D) Power System Operation and Control	D) Artificial Neural Network	D) Statistical Signal Processing

EEU 701 SWITCHGEAR AND PROTECTION

Teaching Scheme: 03 L + 00 T

Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Circuit Interruption: Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

Fuses: Types, Constructional features, operation, Characteristics and Applications

Circuit Breaker: Air break, Air blast, minimum oil-type, SF6, Vacuum, Miniature, Earth leakage and Moulded Case – types constructional features, operation and application.

Relaying Principle: Components, Essential features, Characteristics, Terminology, CT's and PT's, Relay classification.

Electromechanical Relays: Over current, Directional, Distance and Differential – types, constructional features, operation, characteristics and application.

Protection of Transmission Lines

Relaying schemes: over current, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.

Protection of Transformers, Motors, Generators and Buses.

Modern trends in power system protection

Basic concepts, equipments, comparators, Characteristics realization – over current, directional, differential and distance relay. Introduction to numerical relay. Block Diagram of Numeric relay.

Text Book:

1. Power System Protection and Switchgear, Badri Ram and B. N. Vishwkarma, 3rd Edition Tata Mc-Graw Hill Publishing Company Limited, New Delhi. 2003.
2. Power System Protection and Switchgear, B. Ravindranath and M Chander, Wiley Eastern Ltd, New Delhi, 2006.
3. Fundamental of power system protection, Y.G. Paithankar and S. R. Bhide ,PHI publications, 2008

Reference Books:

1. Switchgear Handbook, R. T. Lythall, J and P Newness Butterworth, London. 1993.
2. Power system protection and switchgear, Bhuvanesh A Oza and Nair, Tata McGraw Hill Education private limited New Delhi.
3. Protective Relaying, A. R. Van and C Warrington , Chapman Hall, London.,2 Edition, Vol 1 and 2, 2000
4. Generation Protection and Switchgear, V. A. Slabikov, CIT Press, Coimbatore. 1998.
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU 702 LINEAR AND DIGITAL INTEGRATED CIRCUITS

Teaching Scheme: 03 L + 00 T

Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Linear Integrated circuit

Review of op-amp ; Applications of op amp as V to I converter, dc and ac voltmeter, match diode finder, LED tester, zener diode tester using V to I converter, using I to V converter, light intensity meter using I to V converter. Instrumentation amplifier, Application of instrumentation amplifier as temp controller, temperature indicator, Light intensity meter, flow measurement thermal conductivity measurement, weigh scale; phase detector voltage comparator, window detector, time marker generator, Schmitt trigger; voltage limiter; practical differentiator; practical integrator; logarithmic amplifier; analog amplifier; use of op-amp in medical electronics; electronic thermometer; simulation of inductance using op-amp; sine square and triangular waveform generator.

Timer-IC 555, monostable and astable multivibrator using IC 555; series and shunt regulated power supply, IC 723, IC 7805 etc; phase locked loop (PLL), applications of PLL, IC 565.

Digital Circuits

Combinational logic design using MSI circuit.

Introduction, Multiplexers and their use in combinational logic design, Demultiplexers / decoders and their use in combinational logic design, adders and their use as subtractors, BCD arithmetic, Arithmetic logic Unit (ALU), Digital comparators, Parity generators, code converters, priority encoder, decoder drivers for display devices.

Programmable Logic devices

Introduction, ROM as PLD, Programmable Logic Array, Programmable Array Logic, Complex Programmable Logic Devices (CPLDs), Field- Programmable Gate Array (FPGA)

Computer aided design of digital systems

Introduction, CAD concept, CAD tools, Introduction to VHDL, describing combinational circuits using VHDL, describing sequential circuits using VHDL

Text Books

1. Op-amps and Linear Integrated Circuits Technology, R.A.Gaikwad, PHI publication, 1999
2. Modern Digital Electronics, R.P. Jain, 3rd edition, Tata Mc-Graw Hill, 2005

References

1. Linear Integrated Circuits, D.Roy Chaudhari ,New Age International Publisher, 2005
2. Design of Operational Amplifier and Analog Integrated Circuits, S.Franco TMH Publication, 2002
3. Digital Electronics-Circuits and Systems, V. K. Puri, 1st edition, Tata McGraw Hill Publications, 2003
4. Digital Principles and Application, A. P. Malvino, D. P. Leach, 6th edition, Tata Mc-Graw Hill,2006.

EEU703 ELECTIVE-I
(A) DIGITAL SIGNAL PROCESSING

Teaching Scheme: 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Signals and Signal Processing : Characterization and classification of signals, Typical signal processing operations , Typical signal processing applications, Advantages of digital signal processing
Time Domain Representations of Signals and Systems: Discrete time signals, Operations on sequences, Discrete time systems, linear time invariant discrete time systems, Characterization of LTI systems.

Transform Domain Representation of Signals And Systems: The discrete time Fourier transform, The frequency response, The transfer function, Discrete Fourier series, Discrete Fourier transform, Computation of DFT, Linear convolution using DFT, The z-transform, The region of convergence of z transform

Structures for Discrete Time Systems: Block diagram and signal flow representation of constant coefficient, linear difference equation, Basic structures for IIR systems, Basic structures for FIR systems, Lattice structures, Effects of coefficient quantization, Effect of round off noise in digital filters, Zero-input limit cycles

Filter Design Techniques: Design of discrete time IIR filters from continuous time filters, Design of FIR filters by windowing, Optimum approximation of FIR filters, linear phase filters

Text Book:

1. Digital Signal processing A computer Based Approach by S.K.Mitra;
3rd Edition; McGraw Hill, 2007

Reference Books:

1. Digital Signal Processing by Proakis and Manolakis; 3rd Edition ;
Pearson Education 2006
2. Digital Signal Processing by Ashok Ambardar Thomson Learning 2011
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EEU703 ELECTIVE-I
(B) ADVANCED MICROPROCESSOR

Teaching Scheme: 03 L + 00 T

Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

8086 Microprocessor Architecture - Segmented Memory - Addressing Modes - Instruction Set - 8086 Assembly Language Programming - 8087 Numerical Data Processor Architectural details - Data types - Floating point Operations - 8087 Instructions.

Architectural details of 80386 Microprocessor - Special registers - Memory management - Operation in protected mode and virtual 80386 mode - Memory paging mechanism - Special instructions of 80386 - Architectural details of 80486 - Special registers - Additional instructions - Comparison of 80386 and 80486 processors.

Introduction to Pentium Processor - Architectural features - Comparison with the workstations - Branch prediction logic - cache structure. - Special Pentium Registers. Memory management - virtual mode of operation - Comparison with the previous processors. Features of Pentium-II, Pentium-III and Pentium Pro-processors.

RISC Microprocessors – RISC Vs CISC – RISC Properties – DEC Alpha AXP Architecture - Power PC – Architecture - Programming Model – Data Types – Addressing Modes – Instruction Set. Sun SPARC – Architecture – Data Types – Instruction Sets - Features of MIPS, AMD Microprocessors

Text Books:

1. Barry B Brey “Intel Microprocessors : 8086/88, 80186/188, 80286, 80386, 80486, Pentium, Pentium – II, Pentium – III and Pentium – IV, Architecture, Programming & Interfacing”, Pearson Education, 2003

Reference Books:

1. Badri Ram, “Advanced Microprocessors and Interfacing”, Tata McGraw Hill.
2. A.K. Ray & K.M. Bhurchandi, “Advanced Microprocessors & Peripherals, Architecture,

EEU703 ELECTIVE-I

(C) COMPUTER METHODS IN POWER SYSTEM ANALYSIS

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Graph of a power system, incidence matrices, primitive network, formation of network matrices by singular transformation

Representation of power system for computerized analysis: mathematical model of synchronous generator for steady state and transient analysis, transformer with tap changer, phase shifter, transmission line, and loads.

Algorithm for formation of bus impedance matrix for systems without mutual coupling, modification for changes in the network. Incidence and network matrices for three phase network, transformation matrices, algorithm for formation of bus impedance matrix for three phase networks.

Short Circuit Studies: Symmetrical component, Thevenin's theorem and short circuit analysis of multi-node power systems using bus impedance matrix. Short circuit calculations for balanced and unbalanced faults.

Load Flow Analysis: Types of buses, load flow equations, power flow solution through GS and NR methods, decoupled and fast decoupled methods, sparsity.

Transient Stability Analysis: Including synchronous machines, system network and loads, solution of swing equation by Euler's, Euler's modified and RK methods

Economic Load Scheduling: Unit commitment, transmission loss, load scheduling considering transmission losses, unit commitment by dynamic programming method.

Text Books

1. Computer Methods in Power System Analysis, G.W. Stagg & A.H.El-Abiad, McGraw Hill 2003
2. Power System Analysis, Hadi Saadat, TMH 2004

References

1. Modern Power System Analysis (3rd Edn.), Kothari & Nagrath TMH.2004
2. Power System Analysis and Design, B. R. Gupta,
3. Computer Techniques in Power System Analysis, M. A.Pai, TMH
4. Advanced Power System Analysis and Dynamics, L. P. Singh WEL 2002.
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU703 ELECTIVE-I

(D) POWER SYSTEM OPERATION AND CONTROL

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Introduction-System load – variation, load characteristics – load curves and load-duration curves, load factor, diversity factor, load forecasting, simple techniques of forecasting, basics of power system operation and control, reserve margin, load-frequency control, voltage control, Hydrothermal coordination.

Economic Operation and Unit Commitment problem – : Meaning of optimum scheduling, UCP and LSP, Input – Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost, Methods of obtaining incremental fuel costs, Conditions for incremental loading, Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Transmission loss as a function of plant generation: Calculation of loss co-efficient (Two plant system), Incremental transmission loss, Optimum scheduling of generation between different plants including transmission loss, Concept and significance of penalty factor, Automatic load dispatch: Operation and Functions.

Generator Control Loops: Concept of real and reactive power, Effect of real and reactive power on system parameters, Philosophy of real and reactive power control, Basic generator control loops.

Automatic Voltage Regulator (AVR): Functions of AVR, Types of Exciter, Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Automatic Load Frequency Control: Automatic generation control (AGC), Speed governing system, Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load, Transfer function representation of an isolated generator, Static performance of speed governor , Closing of ALFC loop.

Control Area: Meaning, Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results, Secondary ALFC loop, Integral Control, Pool operation, Tie-line Modeling, Two area system – Dynamic response, Tie-line bias control.

Text Books

1. Electric Energy Systems Theory: An Introduction, O. L. Elgerd, Second edition, McGraw-Hill Book Comp. N.Y. 1987.
2. Power System Analysis, Hadi Saadat, WCB/McGraw-Hill International Edition 1999

References

1. Modern Power System Analysis, I. J. Nagrath, D. P. Kothari, Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi. 2000
2. Economic Operation of Power System, L. K. Kirchamayar Wiley Eastern Pvt. Ltd., New Delhi 2007
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EEU 704 INTERDISCIPLINARY ELECTIVE
(A) ELECTROMECHANICAL ENERGY CONVERSION

Teaching Scheme : 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Electric and Magnetic Field Calculations: Magnetic circuit calculations for devices and machines, Theory of electrostatic and magnetic fields, Fundamental equations, Fields of simple geometries.

Electromechanical Energy Conversion: Energy storage in singly and multiply-excited systems, Mechanical force and stored energy, Electromechanical transducers and their analysis, Reluctance type devices, Energy dissipation- resistance, eddy current, hysteresis and dielectric loss, Lagrange's equation.

Induced Voltage, Armature Reaction and Torque: Induced voltage in windings of ac and dc machines, Armature reaction- MMF of a single coil and uniformly distributed conductors, Rotating magnetic fields in ac machines, Torque in dc and three-phase ac machine, Torque of mutually coupled coils.

Dynamics of Electric Machines: Dynamics of dc machines, Dynamic response of first and second order linear systems, Voltage regulation of separately-excited dc generator, Speed control of separately-excited dc motor, Synchronous-machine dynamics, Parallel operation and synchronizing of alternators.

TEXT BOOKS

1. Electro-mechanical energy conversion with dynamics of machines, Rakosh Das Begamudre, Second Edition, New Edge International Publishers, New Delhi.-2008
2. Electric Machines, I J Nagrath and D P Kothari, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 2003

REFERENCE BOOKS

1. Principles of Electro-mechanical energy conversion, Del Toro V, Prentice-Hall, Englewood Cliffs, N J.
2. Electric Machinery, Fitzgerald A E and Kingslley C, 1st to 4th Editions, McGraw-Hill Book Company.
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EEU 704 INTERDISCIPLINARY ELECTIVE (B) ROBOTICS AND AUTOMATION

Teaching Scheme : 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min

Introduction: Robot definition, Robot classification, Robotic system components. Notations, Position definitions, Coordinate frames, Different orientation descriptions, Free vectors, Translations, rotations and relative motion, Homogeneous transformations, Spatial Descriptions and Transformations.

Manipulator Kinematics and Mechanics of Robot Motion: Link coordinate frames, DenavitHartenberg convention, Joint and end-effectors, Cartesian space, Forward kinematics transformations of position, Inverse kinematics of position, Translational and rotational velocities, Velocity Transformations. Manipulator Jacobian. Forward and inverse kinematics of velocity, Singularities of robot motion, Static Forces, Transformations of velocities and static forces, Joint and End Effectors force/torque transformations.

Manipulator Dynamics: Trajectory Planning, Control. Lagrangian formulation, Model properties, Newton-Euler equations of motion, Joint-based motion planning, Cartesian-based path planning. Independent joint control, Feed-forward control, Inverse dynamics control, Robot controller architectures, Implementation problems.

Automated Manufacturing Systems: Introduction, Manufacturing systems, Performance measure, Computer controlled machines, Material handling systems, Plant layout. Flexible manufacturing system, Computer control system.

Texts Books

1. Introduction to Robotics: Machines and Control, John J. Craig, 3rd Edition, Prentice Hall -2004

References

1. Modeling Identification & control of Robot , W.Khalil & E.Dombare , McGraw Hill -2005
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EEU705 SWITCH GEAR AND PROTECTION LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course EEU701) from the list or otherwise.

Minimum eight experiments should be performed.

- 1) Characteristics of Miniature circuit breaker
- 2) Characteristics of rewritable fuse
- 3) Operation of Parallel feeder
- 4) Combined protection for generator transformer unit
- 5) Various circuit breakers
- 6) Over current relay characteristics
- 7) Earth fault relay
- 8) Generalized protection scheme

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.

EEU706 LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

Minimum Ten experiments based on syllabus of EEU 702 Linear & Digital Integrated circuits. Representative list of experiments is as follows.

1. Inverting amplifier using IC 741 and its frequency response.
2. Non-inverting amplifier using IC 741 and its frequency response.
3. Summing amplifier- to build summing amplifier in inverting and non-inverting mode.
4. Measurement of Op-amp parameters: Input offset voltage, input bias current. Input offset current, CMRR.
5. Measurement of slew rate.
6. To build voltage comparator and to generate the waveforms on CRO.
7. Voltage limiter-to build Voltage limiter and to generate the output waveforms.
8. Differentiator -to build and to generate the output waveforms for various values of R and C.
9. Integrator -to build and to generate the output waveforms for various values of R and C.
10. Precision rectifiers-to build precision rectifiers and to generate the output waveforms
11. To verify different logic gates.
12. Realization of half adder using gates.
13. Realization of half subtractor using gates.
14. Implementation of full Adder circuit using gates.
15. To study Flip-Flops.
16. To Study counters.

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

EEU707 ELECTIVE I LAB

(A) DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme: 02 P Total: 02

Evaluation Scheme: 25 ICA + 25 ESE

Duration of ESE: 3 Hrs

Credit: 01

Total Marks: 50

Representative list of experiments is as follows. Minimum 10 experiments to be performed.

1. To study basic discrete-time signals and operations.
2. To learn how to represent and implement discrete-time signals using MATLAB
3. To study convolution and correlation of discrete-time signals
4. To learn how to implement the two operations using MATLAB
5. To study the sampling principle and the effect of sampling on the frequency-domain quantities
6. To study and investigate the Discrete Fourier Transform
7. To learn how to implement the operation using MATLAB
8. To learn how to analyze discrete-time signal using DFT
9. To learn how to synthesize discrete-time signal using IDFT
10. To study and investigate the Fast Fourier Transform algorithm.
11. To learn how to analyze discrete-time signal using FFT
12. To learn how to synthesize discrete-time signal using IFFT
13. To determine specifications needed for FIR filter design.
14. To learn how to design the FIR filters using window techniques.
15. To learn how to implement the designed FIR filter by MATLAB.
16. To determine specifications needed for IIR filter design.
17. To learn how to design and implement IIR filters using MATLAB.

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

EEU707 ELECTIVE I LAB

(B) ADVANCED MICROPROCESSOR LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

Minimum Ten program must be entered and executed covering the Entire Syllabus of EEU703, (Advanced Microprocessor)

LIST OF MICROPROCESSOR LAB EXPERIMENTS

1. Write an ALP to transfer a block of N word from source block to the destination block, without overlap.
2. Write an ALP to transfer a block of N word from source block to the destination block, with overlap.
3. Write an ALP to interchange a block of N-bytes / words.
4. Write an ALP to add the two given N-bit multi precision numbers $\{N \geq 32 \text{ bits}\}$.
5. Write an ALP to multiply two 32-bits unsigned hexadecimal numbers.
6. Write an ALP to divide an unsigned N-bit hexadecimal number by an unsigned Hexadecimal byte (N to be specified $> 16 \text{ bits}$).
7. Write an ALP to check whether the given 8-bit data is a. Positive or Negative. b. Odd or even. c. Find the logical 1's and 0's in the given data.
8. Write an ALP to find the HCF of two 16-bit unsigned numbers.
9. Write an ALP to find the LCM of two 16-bit unsigned integers.
10. Write an ALP to find the factorial of a number N ($N \leq 9$).
11. Write an ALP to convert 16-bit BCD number to its Hexadecimal equivalent.
12. Write an ALP to convert a given 16-bit Hexadecimal number to its BCDequivalent. Display the result.
13. Write an ALP to find the square and cube of a given 32-bit hexadecimal number.
14. Write an ALP to add two strings of ASCII digits. (Length to be specified).
15. Write an ALP to subtract two strings of ASCII digits (Length to be specified).
16. Write an ALP to multiply a string of ASCII digits by a single ASCII digit.
17. Write an ALP to divide a string of ASCII digits by a single ASCII digit.
18. Write an ALP to transfer the given string data to the destination using stringprimitive instructions.
19. Write an ALP to reverse a string and check whether the given string is apalindrome or not.
20. Write an ALP to sort the given set of 16-bit unsigned integers inascending/descending order using Bubble sort algorithm.
22. Write an ALP to sort the given set of 16-bit unsigned integers inascending/descending order using Insertion sort algorithm

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

EEU707 ELECTIVE I LAB

(C) COMPUTER METHODS IN POWER SYSTEM ANALYSIS LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU703 Elective I (C) (Computer Methods in Power System Analysis) using MATLAB/ SIMULINK/ Power world Simulator. Representative list is as follows –

01. To Form Y_{bus} matrix using singular transformation.
02. To Form Y_{br} matrix using singular transformation.
03. To Form Z_{loop} matrix using singular transformation.
04. To Form Z_{bus} matrix using step-by-step method.
05. To Form Y_{bus} matrix using step-by-step method.
06. To perform load flow analysis using Gauss-Seidel method.
07. To perform load flow analysis using Newton-Raphson method.
08. To perform short circuit analysis for a particular type of fault (LG / LL / LLG / LLL / LLLG)
09. Solution of swing equation by Euler's method.
10. Solution of swing equation by Euler's modified method.
11. Solution of swing equation by RK2 method.
12. Unit commitment using equal incremental cost method.
13. Unit commitment using dynamic programming method.
14. Load scheduling considering transmission losses.

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

EEU707 ELECTIVE I LAB

(D) POWER SYSTEM OPERATION AND CONTROL LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU703(D) Elective I Power System Operation and Control using MATLAB/ SIMULINK / Power world Simulator. Representative list is as follows –

1. Unit commitment using equal incremental cost method.
2. Unit commitment using dynamic programming method.
3. Load scheduling considering transmission losses.
4. Visit to a Load Dispatch centre
5. Model of speed governing system
- 6 .Generator Control Loops
7. Automatic Voltage Control
8. Static performance of speed governor
9. Dynamic response of speed governor
10. Automatic Load Frequency Control

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.

EEU708 PROJECT PHASE - I

Teaching Scheme : 04 P Total: 04
Evaluation Scheme: 50 ICA

Credit: 02
Total Marks: 50

- 1 In general, a group of 3-6 students should be allowed to complete the project on Approved topic.
- 2 Preferably more than 25 % projects shall be Industry / Research based / oriented.
- 3 Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.
- 4 Students should finalize the topic for the project after literature survey in consultation with the Guide.
- 5 The **Synopsis/Abstract** on the selected topic should be submitted to the H.O.D. for approval.
- 6 On approval of the topic, students should initiate the topic based work.
- 7 Approximately more than 30% work(of the total quantum) should be completed by the end of VII semester.
- 8 At the end of semester, each batch should submit the progress report in following format:
Title
Introduction
Concept
Work completed
Work to be completed
References
- 9 For uniform and continuous evaluation, the Evaluation Committee comprising of the Guide, Project Course Coordinator and Expert appointed by the Program Head will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted by the panel of examiners.

EEU709 SEMINAR

Teaching Scheme : 02 P Total: 02
Evaluation Scheme : 50 ICA

Credit: 02
Total Marks: 50

1. Student shall select a topic for seminar which is **not covered in curriculum**.
2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head.
3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:
Introduction
Literature Survey
Concept
Functional and Technical Details
Future scope
Applications
Comparison with similar topics / methods
References
5. Student shall deliver a seminar based on submitted report. The presentation and oral examination on selected seminar topic shall be assessed by panel of examiners

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Seminar Topic and the knowledge acquired. The seminar shall be assessed by the examiner panel consisting of Project Guide, Course Coordinator Seminar and Expert appointed by Program Head.

EEU710 INDUSTRIAL TRAINING/VISIT

Teaching Scheme: 00
Evaluation Scheme: 50 ICA

Total: 00 Credits: 01
Total Marks: 50

Industrial Training shall have an option of Industrial Visit.

Industrial Training: List of renowned industries shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal and with the consultation of Industry personnel, 02 weeks trainings shall be arranged during the vacations (after the VI semester). The students may be permitted to undergo the trainings of 02 weeks as per their choices for which all the official formalities will be completed by the students under the guidance of course coordinator. The students shall submit the report based on the Industrial training to the course coordinator which will be evaluated during the VII semester

Industrial Visit: An Industry Visits to minimum three industries shall be arranged for the students unable to complete the Industrial Training. The visit shall be arranged preferably during the vacation period. However in non-availability of permission for the visit during vacation period, same may be

arranged during the regular VII semester. The students will be required to submit the report based on the Industrial Visit which will be evaluated by the course coordinator

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the training/visits and knowledge / skill acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

EEU711 INDUSTRIAL LECTURE-II

Teaching Scheme: 01 L
Evaluation Scheme: 25 ICA

Total: 01 Credits: 01
Total Marks: 25

List of renowned persons from industry shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal, Minimum twelve Industrial lectures shall be arranged, preferably once a week, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors covering the various aspects.

The assignments based on the Industry Lecture-I and Industry Lecture-II will be evaluated during VII semester

Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.

Students shall submit the report based on lectures.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the lectures and knowledge acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head.

EEU712 SELF STUDY-III

Teaching Scheme: 00 P Total: 00
Evaluation Scheme: 25 TA

Credit: 02
Total Marks: 25

1] Self study - III is based on one class test each on the basis of 20% curriculum of the courses EEU701,EEU702,EEU703 declared by respective course coordinator at the beginning of the semester

2] One faculty member shall be appointed as course coordinator for Self Study - III and his/her work load shall be considered as 1 hr/week.

EEU801 POWER SYSTEMS STABILITY

Teaching Scheme: 03 L + 00 T

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE: 2 Hrs.30 min

Total: 03 Credits: 03

Total Marks: 100

Basics of Power System Stability: Concept of stability, types of stability, modeling of power system components for stability studies, power system dynamics, swing equation, factors affecting stability and recent trends for improving stability

Small Disturbance Stability: Steady state stability of two-machine system, power angle curve, stability criterion, definition and computation of SSSL by analytical and graphical methods, effect of inertia, saliency, saturation, governor action and SCR on SSSL

Large disturbance Stability: Single machine infinite bus (SMIB) system, classical model, equal area criteria technique and its applications to various types of disturbances, point by point method for solving swing equation

Excitation System: Effect of excitation system on generator power limit, various types of excitation systems, transformation model of excitation system

Text Books

1. Power System Analysis, Hadi Sadat, Tata McGraw Hill, 2005
2. Modern Power System Analysis, Nagrath and Kothari, McGraw Hill, 2005

References

1. Power System stability and Control, P.Kundur, McGraw Hill, New York, 2007
2. Power System Stability, E.W.Kimbark, Vol 1 and 3 , Dover Publications 1999
2. Power System Dynamics, Stability and Control, K.R.Padiyar Interline Publishers, Ban galore, 2007
3. Power System Control and Stability, P.M Anderson and A.A. Fouad, McGraw Hill, 2004
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU802 ELECTRICAL DRIVES AND CONTROL

Teaching Scheme: 03 L + 00 T

Total: 03 Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min

Introduction to Electrical Drives: Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

Starting and Braking of Electrical Drives: Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, braking of d c and induction motors.

DC Drives: Single phase half, full and dual converter based d c drives - Circuit configurations, input/output waveforms, Calculation of torque, speed, power factor, firing angle etc. Torque-Speed characteristics. DC Chopper based d c drives - Circuit configurations, input-output waveforms, Calculation of torque, speed, duty cycle etc. Torque-Speed characteristics.

Induction Motor Drives: Scalar control of induction motor – stator voltage and stator frequency control using stator voltage controllers and inverters – circuit configurations, calculation of current, torque, speed etc. Torque-Speed characteristics. Slip power recovery schemes – rotor chopper / inverter control of induction motor - Circuit configurations and theoretical concepts only.

Industrial Applications: Electrical drives system for rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

Text Books

1. Fundamentals of Electrical Drives, G. K. Dubey, Narosa Publishing House, 2005
2. Electric Drives-Concepts and Applications, V.Subrahmanyam TMH Pub, 2004
3. A first course on Electrical Drives, S.K.Pilley Wiley Eastern Pub, 2002
4. Electric Drives, De and Sen PHI Pub, 1999

References

1. Thyristor DC Drives” P.C.Sen John Wiley & Sons, 1981.
2. Power Electronic Control of AC Motors”, JMD Murphy & FG Turnbull, Pergamon Press, 1988.
3. Power Semiconductor Controlled Drives”, G.K. Dubey PH Int., 1989.
4. Power Semiconductor Drives” Deewan, Straughan & Slemon John Wiley & Sons.
- 5 <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU803 Elective-II

A – MULTIRATE DSP AND WAVELET

Teaching Scheme: 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Beginning with some practical situations, which call for multi-resolution / multi-scale analysis - and how time-frequency analysis and wavelets arise from them. Examples: Image Compression, Wideband Correlation Processing, Magnetic Resonance Imaging, Digital Communication.

Piecewise constant approximation: Haar wavelet, Building up the concept of dyadic Multi-resolution Analysis (MRA), Relating dyadic MRA to filter banks, review of discrete signal processing. Elements of multi-rate systems and two-band filter bank design for dyadic wavelets.

Families of wavelets: Orthogonal and biorthogonal wavelets. Daubechies' family of wavelets in detail. Vanishing moments and regularity. Conjugate Quadrature Filter Banks (CQF) and their design. Dyadic MRA more formally. Data compression - fingerprint compression standards, JPEG-2000 standards.

The Uncertainty Principle and its implications: the fundamental issue - the problem and the challenge that nature imposes. The importance of the Gaussian functions: the Gabor Transform and its generalization; time, frequency and scale - their interplay. The Continuous Wavelet Transform (CWT). Condition of admissibility and its implications. Application of the CWT in wideband correlation processing.

DWT: Discretization in steps. Discretization of scale - generalized filter bank. Discretization of translation - generalized output sampling. Discretization of time/ space (independent variable) - sampled inputs.

Variants of the wavelet transform and its implementational structures: An exploration of applications (this will be a joint effort between the instructor and the class). Examples: Transient analysis; singularity detection; Efficient signal design and realization: wavelet based modulation and demodulation; Applications in mathematical approximation; Applications to the solution of some differential equations; Applications in computer graphics and computer vision; Relation to the ideas of fractals and fractal phenomena.

Text Book:

1. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Pearson Education, Low Price Edition, ISBN 81 – 7758 – 942 – 3.

Reference Books:

1. Howard L. Resnikoff, Raymond O. Wells, "Wavelet Analysis: The Scalable Structure of Information", Springer, 1998: available in Indian Edition.

2. Raghuveer M. Rao, Ajit S. Bopardikar, "Wavelet Transforms: Introduction

3. K. P. Soman, K. I. Ramachandran, "Insight into Wavelets - From Theory to Practice", Prentice Hall of India, Eastern Economy Edition, ISBN Number 81-203-2650-4.

4. Michael W. Frazier, "An Introduction to Wavelets through Linear Algebra", Springer, ISBN 3-540-780-75-0, c 1999,

5. www.ocw.mit.edu

EEU803 Elective-II

B - HIGH VOLTAGE ENGINEERING

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Mechanism Of Breakdown In Gases: Classification of insulating materials. Gases as insulating media, Ionization & decay process, breakdown in gases, Townsend's law. The streamer mechanism of spark Paschen's law, corona discharge, electronegative gases

Breakdown In Liquid And Solid Dielectrics : Breakdown in pure and commercial liquids, Solid Dielectrics and composite dielectrics, High Voltage bushings, Guarding, Shielding, Field Plotting.

Lightning and Switching over Voltages and Protection: Lightning strokes to lines and towers, mechanism & characteristics. Protection of transmission lines from lightning, Lightning Arrestors. Insulation to co-ordination of HV and EHV transmission line, Power system and substation.

High Voltage and Current Generation: Generation of High D.C, A.C. and Impulse voltages, Standard impulse wave shapes, Switching Surges , High Impulse Generator

High Voltage And Current Measurement: Peak voltage, Impulse voltage and High Direct current Measurement methods, Non-destructive measurement and testing, High Voltage dielectrics Loss and capacitance measurement, Radio Frequency and partial discharge measurement.

High Voltage Testing: Basic Terminology, Testing – Insulation, Bushings, Cables, Transformers, Surge Diverters and Isolators, Electric Shock and threshold current

Text Book

1. High Voltage Engineering, Naidu M.S. and Kamaraju V Tata McGraw Hill Pub. Co. New Delhi Third Edition

References

1. High Voltage Engineering, E. Kuffel and W.S. Zaenglo, Pergamon Press
2. EHV AC Transmission Engineering, Rokosh Das Begamudre, Wiley Eastern Ltd. New Delhi.
3. High Voltage Engineering, D.V.Razevig, Khanna Pub. New Delhi
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU803 Elective-II

C- NETWORK SYNTHESIS

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Synthesis of one port network: Introduction, Hurwitz polynomial, Routh's criterion, positive real function, Frequency response of reactive one-ports, synthesis of reactive one-ports by Foster's and Cauer method, synthesis of R-L network by Foster's and Cauer method, synthesis of R-C network by Foster's and Cauer method.

Passive Filters: Introduction, classification of filter networks, characteristic impedance in the pass and stop bands, constant-K- low pass, high pass, band pass and band stop filters, principles of m-derived filters, the m-derived T and π sections, m-derived- low pass, high pass and band pass filters, terminated m-derived half sections, impedance matching of filters, design of composite filters.

Attenuators: Introduction, Symmetrical attenuators – T type, π type, bridged-T and lattice attenuators, Asymmetrical attenuators – T type, π type, L type attenuators.

Equalizers: Introduction, Inverse network, series equalizer, full series equalizer, shunt equalizer, constant resistance equalizer, bridge T-attenuation equalizer, lattice attenuation equalizer, lattice phase equalizer.

Active filters: Introduction, Filter function definitions, second order Sallen-key filters – active low pass, active high pass and active band pass filters, cascading of active filters, Butterworth filters – first order low pass, second order low pass, second order band pass and high pass filters, Chebyshev filters, switched capacitor filters – resistance simulation, realization of integrator, realization of gain stages, realization of one pole section.

Digital Filters: Digital filter as a system, digital filter networks, discrete time elementary functions, realization of digital filters – direct realization, direct canonic realization, cascade realization, parallel realization, ladder realization, discrete Fourier transform.

Text Books

1. An Introduction to Modern Network Synthesis, M. E. Van Valkenberg
2. Circuits and Networks – Analysis and Synthesis, A. Sudhakar & S. S. Palli (4th Edn.), TMH 2011.

References

1. Engineering Network Analysis and Filter Design, G. G. Bhise, P. R. Chadha & D. G. Kulshreshtha, Umesh Publications 2004.
2. Circuit Theory – Analysis and Synthesis, A. Chakrabarti, Dhanpatrai & Co. 2001.
3. Networks and Systems (2nd Edn.), D. Roy Choudhary, New Age International Publishers, 2010

EEU803 Elective-II

D - ARTIFICIAL NEURAL NETWORK

Teaching Scheme: 03 L + 00 T Total: 03

Credits: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Introduction: Introduction to Artificial Intelligence, Artificial Neural Network (ANN), Characteristics of ANN

Biological neurons: Function of single biological neuron, Comparison of brain and computer, Comparison between Artificial and Biological neural network.

Basic terminology related to artificial neuron, Basic building blocks of ANN. Network architecture, setting of weights, Activation functions.

Fundamental Models of ANNs and Learning Processes: McCulloch Pitt's neuron model, Hebb net. Concept of Learning with a Teacher, Learning without a Teacher, Different Learning rules such as Hebbian learning rule, Perceptron learning rule, Delta and extended delta learning rule, Competitive learning rule, outstar learning rule, Boltzman learning rule. Concept of Linear separability

Single Layer Network and Multi-layer Network : Single Layer Perceptron: architecture – training algorithm, Application Procedure, different performance indices, different training stopping conditions and their limitations, learning curves.

Adaline and Medaline Networks: Architecture, Training and Application Algorithms

Back Propagation Network: Architecture, Back propagation Learning algorithm, Selection of parameters, Concept of learning rate, momentum coefficient, Local and global minima, Advantages and disadvantages of BPN.

Radial Basis Function Network: Architecture, Training algorithm

Self Organizing Feature Map: Concept of clustering, Concept of winner unit, methods for determining the winner unit, Kohonen self organizing Feature Map (SOFM).

Applications of ANN: Applications of ANN in bioinformatics, Forecasting (Regression), Pattern recognition (Classification)

Text Books

1. Introduction to Neural Network using MATLAB 6.0, S. N. Sivanandam, S. Sumathi, S. N. Deepa, Tata McGraw-Hill, 2009
2. Neural Networks: A Comprehensive Foundation, Simon Haykin, 2nd Edition, Pearson Education 2007

References

1. Understanding Neural Networks and Fuzzy Logic – Basic Concepts and Applications, S. V. Kartalopoulos, PHI, 2005
2. Introduction to Neural Network, Anderson J.A., MIT press, Cambridge 2006
3. Neural Network, A classroom Approach, Satish Kumar, McGraw Hill, 2008
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU804 Elective-III
A – HVDC AND FACTS

Teaching Scheme: 03 L + 00 T Total: 03

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE

Duration of ESE: 2 Hrs.30 min.

Credits: 03

Total Marks: 100

DC Power Transmission Technology: Introduction, comparison of AC & DC Transmission, application of DC transmission, Description of DC transmission systems, planning & modern trends.

Analysis of HVDC Converters :3-pulse, 6-pulse,12-pulse converters , converters station and terminal equipment , commutation process, rectifier & inverter operation, equivalent circuit for converters , simplified analysis of Graetz circuit.

Control of Converters and HVDC System Control: Firing angle control, Current and extinction angle control, starting and stopping of DC link, power control, higher level Controllers, Converter faults and protection: Introduction, Converter faults, protection against over current, over voltage in a converter station, surge arrestors. Smoothing reactor.

Multi Terminal DC Systems: Potential applications of MTDC systems, types of system, operation & control and protection of MTDC systems. Parallel operation of HVDC

Flexible AC Transmission Systems (FACTS): Steady state and dynamics problems in AC systems, Introduction of Flexible AC transmission systems (FACTS) Necessity & objectives of FACTS,

Basic Types of FACTS Controller: Description of static var compensation (SVC), Thyristor controlled series compensation (TCSC), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPSC)

Text Books

1. HVDC Transmission, Padiyar K.R, Wiely Eastern Ltd; New Delhi
2. Understanding FACTS: Concepts and Technology of flexible AC transmission system, Hingorani N. G. & Gyugyi L., IEEE press 2000.

References

1. Direct Current Transmission, Kimbark E.W., John Wiley & Sons, 1999
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EEU804 Elective-III

B - HIGH VOLTAGE TRANSMISSION

Teaching Scheme: 03 L + 00 T Total 03

Credit : 03

Marking Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks:100

Duration of ESE: 2 Hrs.30 min.

Extra high voltage AC Transmission: Introduction to EHV-AC transmission, transmission line trends & preliminary aspects, standard transmission voltages-power handling capacities and line losses-mechanical aspects.

Electrostatic field of EHV lines, electric shock & threshold currents, capacitance of long object, Effect of Electrostatic field on Human, Animal.

Over voltages in EHV system: origin & causes, over voltage caused by switching operations, over voltage caused by interruption of low inductive current, over voltage caused by interruption of capacitive currents, ferro-resonance overvoltage Power frequency voltage control , shunt & series compensation .

Lightning: Lightning strokes, Lightning stroke to tower and midspan, Insulation coordination based on lightning.

High Voltage DC Transmission: Introduction to HVDC, Comparison of AC-DC Transmission, Types of HVDC Systems, limitation of HVDC Transmission, planning & modern trends,

Converters Station and Terminal Equipment: Analysis of HVDC Converters: 3-pulse, 6-pulse, commutation process, rectifier & inverter operation, Ground return, Circuit breaking

Converter faults and protection: Introduction, Converter faults, protection against over current ,over voltage in a converter station, surge arrestors. Smoothing reactor, Harmonics and filters

Parallel operation of HVDC and HVAC.

TEXT BOOKS

1. "Extra High Voltage AC Transmission Engineering", Rakosh Das Begamudre ,New Age International(P) Ltd
2. " HVDC Transmission" Wiely Eastern Ltd;" K.R.Padiyar ,New Delhi
3. "HVDC Transmission", S.Kamakshaiah,V.Kamaraju, TMH,2011

REFERENCE BOOKS

- 1 "AC-DC Power System Analysis", Arrillaga, IEE London, 1998.
- 2 "Direct Current Transmission", Kimbark E.W, John Wiley &sons
- 3 www.nptel.iitm.ac.in
- 4 www.ocw.mit.edu

EEU804 Elective-III

C - POWER QUALITY AND DEREGULATION

Teaching Scheme: 03 L + 00 T

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE: 2 Hrs.30 min

Total: 03 Credits: 03

Total Marks: 100

Basic Concepts of Power Quality: Power quality problems in distribution systems, definitions, power quality standards, Harmonics, Harmonic creating loads & its modeling

Mitigation of Power Quality Problems: Harmonics propagation, series and parallel resonance, harmonic power flow, mitigation of harmonics, filters, active filters, shunt and series hybrid filters, voltage sag and swells, voltage flicker, power electronics conditioners

Fundamentals of Restructured System: History of power system restructuring, concept of power system deregulation, regulation vs. deregulation, entities in deregulated system, Indian scenario

Models of Restructuring: PoolCo and bilateral contractual models & power exchange, ISO based markets models, market architecture, day ahead and hour ahead markets.

Transmission Open Access Issues: Available Transfer Capability (ATC) - definition and methods of determination, transmission network congestion, congestion management techniques

Text Books:

1. Electrical Power Systems Quality, Dugan Roger, McGraw-Hill Edition 2002
2. Operation of restructured power system, Bhattacharya Kankar, IEEE Publication.2001

Reference Books:

1. Power System Restructuring, Lai Lee
2. Power Quality Sags and Interruption, Mach Boolean, John Wiley
3. Power Electronics, Ned Mohan John Wiley and Sons -2003
4. Electrical Energy Utilization and Conservation, S.C. Tripathi (TMH Pub.)-2003
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EEU804 Elective-III

D - STATISTICAL SIGNAL PROCESSING

Teaching Scheme: 03 L + 00 T Total: 03

Credit: 03

Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE: 2 Hrs.30 min.

Probability: Sample space and events, Conditional, total probability, Independent event.

The Random Variable: The random variable concept, the definition of random variable, discrete and continuous random variable, mixed random variable, distribution function, density function.

Multiple Random Variables: Bivariate random variables, joint distributions and its properties, joint density and its properties, conditional distributions and density, statistical independence, central limit theorem.

Operations On Random Variables: Expectations, moments, functions that give moments, transformation of random variables, computer generation of one random variable, expected value of function of a random variable, jointly Gaussian random variable, sampling and some limit theorems.

Random Processes: Concept of random process, stationarity and independence, correlation functions, Poisson random process, Wiener process, power spectral density, relation between power spectral density and autocorrelation function.

Linear Systems with Random Inputs: Linear system response to random signals, system evaluation using white noise, discrete time systems, modeling of noise sources, some practical applications.

Text Book:

1. Probability, Random variables and random signal principles 4th edition, Peyton Z Peebles
TMH, 2001

Reference Books:

1. Probability, Random Variables, and Stochastic Processes, Papoulis, TMH, 2003
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EEU805 POWER SYSTEM STABILITY LAB

Teaching Scheme: 02 P

Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU801 POWER SYSTEM STABILITY. The Simulation is to be carried out using software like PSCAD, ETAP, MATLAB/Simulink, Power World and SimPower etc.

Representative list is as follows:

1. To find the Steady State Stability of a two machine system with and without resistance switching
2. To find the Steady State Stability of a two machine system using inductance connected in parallel with the line also without inductance and comment on stability.
3. To find the Steady State Stability of a two machine system with and without capacitance connected in parallel with the line also comment on stability.
4. To obtain the frequency of oscillations in two machine System.
5. To plot the natural response of rotor angle and frequency for two machine system.
6. Determination of maximum power without loss of synchronism using Equal area criterion.
7. To find the Transient stability limit in double circuit line when fault applied in the middle of transmission line.
8. To determine the transient stability in double circuit line when fault applied on either end.

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.

EEU806 ELECTRICAL DRIVES AND CONTROL LAB

Teaching Scheme: 02 P

Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs.

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed. (The laboratory may consist of 2-3 simulation studies based on Matlab - Simulink / PSIM / PSPICE platform and one industrial visit for study of electrical drive.)

Representative List:

1. Converter controlled d c motor.
2. Chopper controlled d c motor.
3. Stator voltage controlled induction motor.
4. Stator frequency controlled induction motor.
5. Plugging / rheostatic braking of d c motor.
6. Plugging / rheostatic braking of induction motor.
7. Study of solid state / soft starters for electrical motors.
8. Study of electrical drive in any industry. (Industrial visit)
9. Simulation of 1 / 2 / 4 quadrant Converter controlled dc drive.
10. Simulation of 1 / 2 / 4 quadrant Chopper controlled dc drive
11. Simulation of open loop / closed loop V/f control of I.M.
12. Simulation of rotor chopper control of I.M.

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

EEU807 Elective-II Lab

A – MULTIRATE DSP AND WAVELET LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

External Total Marks: 50

Duration of ESE: 3 Hrs.

1. Use the command line functions available in the MATLAB signal processing toolbox, to simulate simple multirate DSP systems. The focus here is to be able to view in the frequency domain what is happening at each stage of a system involving upsamplers, downsamplers, and lowpass filters. All computations will be performed using MATLAB and the signal processing toolbox.
2. FIR filter design using multirate technique
3. Design of Two-Channel Orthogonal Filter bank
4. Design of Quadrature Filter Bank

EEU807 Elective-II Lab

B – HIGH VOLTAGE ENGINEERING LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

External Total Marks: 50

Duration of ESE: 3 Hrs.

Minimum Eight Experiments must be performed covering the Entire Syllabus of EEU803 B – HIGH VOLTAGE ENGINEERING

Representative list is as follows:

1. Study of Corona
2. Determine the Breakdown voltage of paper insulator
3. Determine the Breakdown voltage of Transformer Oil
4. Generation High DC Voltage
5. Generation of High AC Voltage
6. Generation of Impulse Voltage
7. Measurement of High AC Voltage with Sphere gap and peak volt meter
8. Measurement of High DC Current
9. Measurement of High frequency and Impulse Currents
10. Measurement of DC Resistivity of conductor
11. Measurement of Dielectric Constant and Loss Factor
12. Testing of Cables
13. Testing of Insulators
14. Testing of Lightning Arrestor

EEU807 Elective-II Lab

C - NETWORK SYNTHESIS LAB

Teaching Scheme: 02 P Total: 02
Evaluation Scheme: 25 ICA + 25 ESE
Duration of ESE: 3 Hrs.

Credit: 01
Total Marks: 50

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU803 Elective II (C) (Network Synthesis). Representative list is as follows –

01. Foster realizations (one port) of the given function.
02. Cauer realizations (one port) of the given function.
03. Design of constant k-low pass filter.
04. Design of constant k-high pass filter.
05. Design of m-derived-T-section-low pass filter.
06. Design of m-derived- π -section-high pass filter.
07. Design of full series equalizer.
08. Design of symmetrical lattice attenuator.
09. Design of fourth order Butterworth low-pass filter.
10. Design of second order Butterworth band-pass filter.
11. Impulse response and unit step response of digital filter network.

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 the experiments and may be followed by sample questions.

EEU807 Elective-II Lab

D- ARTIFICIAL NEURAL NETWORK LAB

Teaching Scheme: 02 P Total: 02

Credit: 01

Evaluation Scheme: 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE: 3 Hrs.

Minimum Eight Experiments to be performed covering the entire Syllabus of EEU803 (D) Elective I (Artificial Neural Networks) using MATLAB/ SIMULINK. Representative list is as follows –

01. To generate a few activation functions that are used in neural networks.
02. To realize the Exclusive OR function using McCulloch-Pitts neuron.
03. To design a two input, one output perceptron to satisfy the given data.
04. To realize a Hebb net for the AND function with bipolar input and targets.
05. Pattern classification using perceptron network.
06. To realize a OR function with bipolar inputs and targets using adaline network.
07. To realize a XOR function with bipolar inputs and targets using madaline network.
08. To get XOR function (binary input and output) with momentum factor using back propagation algorithm.

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 the experiments and may be followed by sample questions.

EEU808 PROJECT PHASE - II

Teaching Scheme : 06 P Total: 06
Evaluation Scheme : 75 ICA + 100 ESE
Duration of ESE: 3 Hrs.

Credit: 06
Total Marks: 175

1. Project work decided in VII semester shall be continued.
2. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
3. Students shall submit the final project report in proper format as per guidelines given on the college website which shall include the work of both semesters.
4. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
5. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head.

ESE: The End Semester Examination for Project shall consists of Demonstration if any, presentation and oral examinations based on the project report.

EEU809 SELF STUDY-IV

Teaching Scheme : 00 P Total: 00
Evaluation Scheme : 25 TA

Credit: 02
Total Marks: 25

1] Self study - IV is based on one class test each on the basis of 20% curriculum of the courses EEU801,EEU802,EEU803 & EEU 804 declared by respective course coordinator at the beginning of the semester

2] One faculty member shall be appointed as course coordinator for Self Study - IV and his/her work load shall be considered as 1 hr/week.

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI.													
Department of Electrical Engineering													
Scheme for B. Tech. (Electrical Engineering)													
SEM III													
Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs /week	Practical Hrs /week	Total	TA	CT1	CT2	ESE	ICA	ESE		
SHU303	Engineering Mathematics - III	3	--	---	3	10	15	15	60	---	---	100	3
ETU311	Electronic Devices and Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU301	Signals & Systems	3	1	---	4	10	15	15	60	---	---	100	4
EEU302	Network Analysis	3	1	---	4	10	15	15	60	---	---	100	4
EEU303	Electrical Measurement and Instrumentation	3	---	---	3	10	15	15	60	---	---	100	3
ETU312	Electronic Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU304	Signals & Systems Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU305	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU306	Electrical Measurement and Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
SHU305	General Proficiency - II	1	---	2	3	---	---	---	---	50	---	50	2
Total		16	2	10	28	50	75	75	300	150	100	750	23
SEM IV													
SHU401	Engineering Mathematics - IV	3	--	---	3	10	15	15	60	---	---	100	3
EEU401	Pulse & Digital Circuits	3	1	---	4	10	15	15	60	---	---	100	4
EEU402	Electrical Machines - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU403	Energy Resources & Generation	3	---	---	3	10	15	15	60	---	---	100	3
EEU404	Electromagnetic Engineering	3	1	---	4	10	15	15	60	---	---	100	4
SHU402	Engineering Mathematics Lab	1	---	2	3	---	---	---	---	25	25	50	2
EEU405	Pulse & Digital Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU406	Electrical Machines - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU407	Numerical Methods Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU408	Computational Lab - I	---	---	2	2	---	---	---	---	25	25	50	1
Total		16	2	10	28	50	75	75	300	125	125	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.

SEM V													
EEU501	Electrical Machines -II	3	---	---	3	10	15	15	60	---	---	100	3
EEU502	Power System Analysis- I	3	---	---	3	10	15	15	60	---	---	100	3
EEU503	Control System - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU504	Introduction to Microprocessor and Microcontrollers	3	---	---	3	10	15	15	60	---	---	100	3
EEU505	Industrial Organization & Management	3	---	---	3	10	15	15	60	---	---	100	3
EEU506	Electrical Machines - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU507	Power System Analysis - I Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU508	Control System - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU509	Introduction to Microprocessor and Microcontrollers Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU510	Computational Lab-II	1	---	2	3	---	---	---	---	25	25	50	2
EEU511	Self Study - I	---	---	---	0	---	---	---	---	25	---	25	2
Total		16	0	10	26	50	75	75	300	150	100	750	23

NOTE :

- 1) Self study - I is based on one class test each on the basis of 20% curriculum of the courses EEU501,EEU502,EEU503,EEU504 declared by respective course coordinator at the beginning of the semester.
- 2) One faculty member shall be appointed as course coordinator for self study - I and his/her teaching work-load shall be consider 1 hr/week

SEM VI													
EEU601	Power Electronics	3	--	---	3	10	15	15	60	---	---	100	3
EEU602	Power System Analysis - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU603	Control System - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU604	Electrical Machine Design	3	---	---	3	10	15	15	60	---	---	100	3
EEU605	Operation Research Techniques	3	---	---	3	10	15	15	60	---	---	100	3
EEU606	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU607	Power System Analysis - II Lab	---	---	2	2	---	---	---	---	25	---	25	1
EEU608	Control System - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU609	Electrical Machine Design Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU610	Minor Project	----	----	2	2	---	----	---	----	25	25	50	2
EEU611	Self Study - II	---	---	----	0	---	---	---	---	25	---	25	2
EEU612	Industrial Lecture - I*	1	---	----	1	---	---	---	---	---	---	0	---
Total		16	0	10	26	50	75	75	300	150	100	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) The ESE duration for all theory courses shall be 2 Hrs 30 Minutes.
- 3) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II
- 4) Self study-II is based on one class test each on the basis of 20% curriculum of the courses EEU601,EEU602,EEU603,EEU604 declared by respective course coordinator at the beginning of the semester.
- 5) One faculty member shall be appointed as course coordinator for self study-II and his/her teaching work-load shall be consider 1 hr/week
- 6)Assessment of Industrial Lecture - I is scheduled in VII sem with Industrial Lecture-II

SEM VII													
EEU701	Switch Gear and Protection	3	---	---	3	10	15	15	60	---	---	100	3
EEU702	Linear & Digital Integrated Circuits	3	---	---	3	10	15	15	60	---	---	100	3
EEU703	Elective - I	3	---	---	3	10	15	15	60	---	---	100	3
EEU704	Interdisciplinary Elective	3	---	---	3	10	15	15	60	---	---	100	3
EEU705	Switch Gear and Protection Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU706	Linear Integrated Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU707	Elective Lab - I	---	---	2	2	---	---	---	---	25	25	50	1
EEU708	Project Phase - I	---	---	4	4	---	---	---	---	50	--	50	2
EEU709	Seminar	---	---	2	2	---	---	---	---	25	25	50	2
EEU710	Industrial Training /Visit	---	---	---	0	---	---	---	---	50	---	50	1
EEU711	Industrial Lecture - II*	1	---	---	1	---	---	---	---	25	---	25	1
EEU712	Self Study - III	---	---	---	0	---	---	---	---	25	---	25	2
Total		13	0	12	25	40	60	60	240	250	100	750	23

NOTE:

- 1) * Credits shall be awarded on the basis of combined assessment of Industrial Lecture-I and Industrial Lecture-II
- 2) Self study - III is based on one class test each on the basis of 20% curriculum of the courses EEU701,EEU702,EEU703 declared by respective course coordinator at the beginning of the semester.
- 3) One faculty member shall be appointed as course coordinator for self study - III and his/her teaching work-load shall be consider 1 hr/week
- 4) Students of this department shall select any on Interdisciplinary Elective offered by other departments. Interdisciplinary Elective shown below will be offered to students of the other department.

SEM VIII													
EEU801	Power Systems Dynamics	3	---	---	3	10	15	15	60	---	---	100	3
EEU802	Electrical Drives and Control	3	---	---	3	10	15	15	60	---	---	100	3
EEU803	Elective - II	3	---	---	3	10	15	15	60	---	---	100	3
EEU804	Elective - III	3	---	---	3	10	15	15	60	---	---	100	3
EEU805	Power Systems Dynamics Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU806	Drives and Control Lab	---	---	2	2	---	---	---	---	25	25	50	1
EEU807	Elective Lab-2	---	---	2	2	---	---	---	---	25	25	50	1
EEU808	Project Phase - II	---	---	6	6	---	---	---	---	75	100	175	6
EEU809	Self study - IV	---	---	---	0	---	---	---	---	25	----	25	2
Total		12	0	12	24	40	60	60	240	175	175	750	23

NOTE:

- 1) TA :Teacher Assessment CT: Class Tests ESE: End Semester Examination ICA : Internal Continuous Assessment
- 2) Duration of ESE is 2 Hrs 30 Minutes for all courses
- 3) Self study - IV is based on one class test each on the basis of 20% curriculum of the courses ,EEU801,EEU802,EEU803,EEU804 declared by respective course coordinator at the beginning of the semester.
- 4) One faculty member shall be appointed as course coordinator for self study - IV and his/her teaching work-load shall be consider 1 hr/week

LIST OF ELECTIVES

Interdisciplinary Elective (EEU704)	Elective - I (EEU703)	Elective II (EEU803)	Elective III (EEU804)
A) Electromechanical Energy Conversion	A) Digital Signal Processing	A) Multirate DSP and Wavelet	A) HVDC and FACTS
B) Robotics and Automation	B) Advanced Microprocessor	B) Computer Application in EE	B) High Voltage Transmission
	C) Computer Methods in Power System Analysis	C) Network Synthesis	C) Power Quality & Deregulation
	D) Power System Operation and Control	D) Artificial Neural Network	D) Statistical Signal Processing

SHU303 ENGINEERING MATHEMATICS III

Teaching Scheme : 03 L Total: 03

Credit: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Linear Differential Equations with constant coefficients:

General solution to L.D.E. of n^{th} order with constant coefficients, rules for finding Complementary function., General method for finding Particular integral, P.I. of some standard functions, Method of Variation of Parameters, Cauchy's and Legendre's L.D.E., simultaneous linear differential equations .

Partial Diff. Equations:

Definition, formation of P.D.E., complete solution of PDE, Linear and non-linear PDE of types (i) $f(p, q) = 0$, (ii) $f(p, q, z) = 0$, (iii) $f(p, q, x, y) = 0$, (iv) $f(p, q, x, y, z) = 0$ ie Lagrange's form $Pp + Qq = R$ and Clairaut's form $z = px + qy + f(p, q)$, (v) Equations reducible to above forms. Complete solution of PDE of first and second order by method of separation of variables.

Vector Calculus:

Scalar and vector point functions, Differentiation of a vector function, Tangent and normal components of velocity and acceleration, orthogonal curves, Operator delta, Gradient of scalar point function & their physical meaning . Divergence and Curl of vector point function & their physical meaning. vector identities, solenoidal and conservative fields. Line integral, work done by force.

Functions of complex variables:

Analytic function, C-R equations (Cartesian & polar), Harmonic function, Milne Thompson method for finding analytic function, Conformal mappings, Bilinear transformation.

Text Books:

- 1) Text book of applied Mathematics, P.N.Wartikar and J.N.Wartikar, Pune vidyarthi griha, Pune 2001.
- 2) Higher Engineering Mathematics, B.S.Grewal, Khanna publication, 6th edition, New Delhi, 1976.

Reference Books:

- 1) Advanced Engineering Mathematics, Kreyzig, John Wiley & sons 9th edition 1995.
- 2) Advanced Engineering Mathematics, John bird 5th edition Elsevier publication 2007.
- 3) Higher Engineering mathematics, C.R.Wiley, 8th edition John Wiley and sons 1999.
- 4) <http://www.nptel.iitm.ac.in/>
- 5) www.ocw.mit.edu

ETU311 ELECTRONIC DEVICES AND CIRCUITS

Teaching Scheme : 03 L Total: 03

Credit: 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Diodes and applications: Diode as rectifiers (analysis of single phase rectifiers), analysis of C, L, LC and π - filter, clipping and clamping circuits. Zener diode as a voltage regulator, opto-coupler.

BJT biasing: Types, overview of construction, working and V-I characteristics of BJT, methods of biasing- analysis and synthesis of voltage divider biasing, d. c. load line, a. c. load line stability and stability factor.

BJT amplifiers: Transistor hybrid model for CE, CB and CC configuration, determination of h-parameters from the characteristics, analysis of CE amplifier circuit using h-parameter.

Concept of darlington emitter follower, bootstrap emitter follower, RC coupled amplifier, transformer coupled amplifier, direct coupled amplifier

FET amplifiers: Advantages and disadvantages of FET, types, overview of construction, working and V-I characteristics of JFET & MOSFET, parameters, method of biasing, common source AC amplifier.

Power & feedback amplifiers: Classification, analysis of class A, B, AB power amplifier – calculation of power gain, efficiency, power dissipation and distortion.

Tuned amplifiers - single tuned, double tuned amplifiers.

The feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifiers. Types and characteristics of voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback.

Oscillators & Multivibrators: Barkhausen criteria, RC oscillators - Wein bridge and phase shift, LC oscillators- Hartley, colpitt's, clapp and crystal oscillators.

Self bias bistable multivibrator, commutating capacitor, Schmitt trigger, self bias monostable multivibrator (MMV) - collector coupled. General features of a time base signal, UJT relaxation oscillator, transistor constant current sweep generator, miller and bootstrap sweep generator.

Text Books:

- 1) Electronic Devices and Circuits, J. Millman, C. Halkias and Satyabrata Jit, 2nd edition Tata McGraw Hill, 2008.
- 2) Electronic Devices and Circuits, D. R. Cheruku and B. T. Krushna, 2nd edition, Pearson Publications 2008.

Reference Books:

- 1) Integrated Electronics, Jacob Millman, Christos C. Halkias, 3rd edition, Tata McGraw Hill. 2006
- 2) Pulse Digital and Switching Waveforms, Jacob Millman, Herbert Taub, Mothiki S. Prakash Rao, 2nd edition, Tata McGraw Hill, 2007
- 3) <http://www.nptel.iitm.ac.in/>
- 4) www.ocw.mit.edu

EEU301/EEU411 SIGNALS & SYSTEMS

Teaching Scheme : 03 L +01T

Total : 04

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Introduction to Signals and Systems, System Properties, Convolution of Signals, Linear Shift Invariant Systems and their Properties.

Introduction to Transforms, Fourier series and Fourier Transform, Convergence of Fourier Transform, Properties of Fourier Transform.

Sampling Theorem, Sampling/Reconstruction of Signals, Realistic Sampling, Aliasing, Introduction to Digital Signal Processing, Discrete Time Fourier Transform and Properties.

Introduction to Laplace Transform and Z-Transform, Region of Convergence, Properties of Laplace and Z Transform, Inverse Laplace and Z Transforms, Rational System Functions.

Text Books:

- 1) Signals and Systems, S. Haykin, 2nd edition, John Wiley and Sons, 1999.
- 2) Analog and Digital Signal Processing, Ambardar A, Thomson Learning, 2005.

Reference Books:

- 1) Signals and systems, Oppenheim and Schaffer Prentice, 2nd edition, Hall India of India, 1997.
- 2) Signal & System: Analysis using, Transform Method and Matlab, M.J.Roberts, 2nd edition, McGraw Hill company Ltd., 2003.
- 3) <http://www.nptel.iitm.ac.in/>
- 4) www.ocw.mit.edu

EEU302 NETWORK ANALYSIS

Teaching Scheme : 03 L +01T

Total : 04

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks : 100

Duration of ESE : 2 Hrs.30 min.

Terminal Element Relationships: V-I relationship for Inductance and Capacitance- Constant Flux Linkage Theorem and Constant Charge Theorem- V-I relationship for Independent Voltage and Current Sources - v-i relationship for dependent voltage and current sources- Source Functions: unit impulse, unit step, unit ramp and inter relationship, sinusoidal input ,generalized exponential input.

Basic Nodal and mesh Analysis: Introduction, Nodal analysis, the super node, mesh analysis, the super mesh, nodal vs mesh analysis, computer aided circuit analysis using Pspice

Useful circuit analysis techniques: Linearity and superposition, source transformations, Thevinin's theorem, Norton's theorem, Maximum power transfer theorem, Delta-wye transformations

Time Domain Analysis of Circuits: Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-Complete Solution for step/impulse/sinusoid voltage/current inputs-Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of d.c steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution-Solution of two mesh circuits by differential equation method-Determination of initial conditions. Time domain analysis using Pspice

Review of Laplace Transforms: Laplace Transform-Transform Pairs-Gate Functions-Shifting Theorem-Solution of Differential Equations by Laplace Transforms-Initial and Final Value Theorems-Laplace Transforms of periodic signals-Inversion of transforms by partial fractions-Convolution Theorem and Convolution Integral. (*Review to be done by students. No class hour will be spent for this review.*)

Transformation of a Circuit into s-domain: Transformed equivalent of inductance, capacitance and mutual inductance -Impedance and admittance in the transform domain - Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain - Solution of transformed circuits including mutually coupled circuits-Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots, using Pspice for transform domain analysis

Sinusoidal Steady State analysis: Introduction, characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function, The phasor, phasor relationships for R L C, impedance and admittance , sinusoidal steady state analysis with phasors, pspice for sinusoidal steady state analysis.

Two Port Networks: two port networks-characterizations in terms of impedance, admittance, hybrid and transmission parameters-inter relationships among parameter sets-Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade - Network Functions-Pole Zero plots and steady state response from pole-zero plots. Use of Pspice for two port networks.

Textbooks:

1. Engineering Circuit Analysis, Hayt & Kemmerly, 7th edition, Tata Mc Graw Hill, 2004

References:-

1. Network Analysis, M.E. Van Valkenberg, PHI , 2005
2. Basic Circuit Theory, Lawrence P Huelsman, 3rd edition, PHI, 2001
3. Circuit and Network Analysis, Sudhakar Shyammohan, Tata Mc Graw Hill, 2005
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU303 ELECTRICAL MEASUREMENT AND INSTRUMENTATION

Teaching Scheme : 03 L Total : 03

Credit : 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks : 100

Duration of ESE : 2 Hrs.30 min.

Measuring Instruments: Classification, deflecting, controlling, damping, breaking torques. Basic principles of operation of Ammeter & Voltmeter: PMMC, MI, Electro dynamic, Electrostatic: construction, Principle of operation, torque equation, Scale shape, errors, merits & demerits of each type.

Wattmeters & Energy meters: Electro dynamic & Induction type: construction, theory of operation, torque equation, errors & demerits, Electronic energy meter.

Analysis of three phase balanced load, Blondel's Theorem, Measurement of active & reactive power & energy in single phase & three phase circuits.

Instrument Transformer: Need of extension of range: extension using shunt & multipliers Instrument transformers: CT & PT, Theory & construction, Phasor diagram, Ratio & Phase angle error, causes of error, applications Hall effect sensors for voltage and current measurement.

Special Measuring Instruments :- Maximum demand indicator, Trivector meter, Frequency meter, P.F. meter, Phase sequence indicator, Synchroscope, stroboscope, potentiometers.

Measurement of circuit parameters: Different methods of measurement of low, medium & high value of resistance, sensitivity & accuracy of different methods.

AC & DC Bridges: Wheatstone, Kelvin, Maxwell, Wein, Hay, Desauty, Anderson, Schearing.

Generalized instrumentation system , characteristics of measurement & instrumentation system Transducers : Definition, classification, specification, selection & loading effect, Displacement, Velocity, force, & Torque transducers, Resistive, Inductive, capacitive, Strain gauge, Piezoelectric, current & voltage transducers.

Text Books:

1. A course in Electrical, Electronics measurement and Instrumentation, A.K. Sawhney, 5th edition, Dhanpat Rai & Sons, 2006

Reference Books:

1. Electrical Measurement and Measuring Instruments, Golding, Wheeler Publishing House, 2003.
2. Electronic Instrumentation, H.S. Kalsi, TMH 2000
3. Fundamentals of Electrical Measurements, C.T. Baldwin, TMH, 1998
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

ETU312 ELECTRONIC DEVICES AND CIRCUITS LAB

Teaching Scheme : 02 P Total : 02

Credit : 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE : 3 Hrs.

Minimum Eight Experiments to be performed covering the Entire Syllabus of ETU311 Electronic Devices and Circuits. Representative list is as follows,

1. To study V-I characteristics of PN- junction diode and Zener diode. Also compare their characteristics.
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 common emitter 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.
15. To study biasing of transistor by following method:
 - a. Fixed bias.
 - b. Voltage divider bias.

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.

EEU304 SIGNALS & SYSTEMS LAB

Teaching Scheme : 02 P Total : 02

Credit : 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE : 3 Hrs.

Minimum Eight Experiments to be performed covering the Entire Syllabus of EEU301 Signals & Systems. Representative list is as follows

1. To study Z-transform of :
 - a) Sinusoidal signals.
 - b) Step Functions.
2. To compare fourier and laplace transorm of a signal.
3. To study convolution theorem in time and frequency domain.
4. To study signal synthesis via sum of harmonics.
5. To study LPF & HPF, band pass & reject filters using RC circuits.
6. To demonstrate how analog signals are sampled & how different sampling rates affect the outputs.
7. To study sampling theorem for low pass signals & band pass signals.
8. To determine the components of :
 - a) Square Wave.
 - b) Clipped Sine Wave.

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.

EEU305 NETWORK ANALYSIS LAB

Teaching Scheme : 02 P Total 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE : 3 Hrs.

Minimum Eight Experiments to be performed covering the Entire Syllabus of EEU302 Network Analysis. 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 find transmission parameters of two, two port networks connected in cascade.
8. To study the response of RL series circuit to sinusoidal input and dc input (using MATLAB).
9. To study the response of RC series circuit to sinusoidal input and dc input (using MATLAB).

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.

EEU306 ELECTRICAL MEASUREMENT AND INSTRUMENTATION LAB

Teaching Scheme : 02 P Total 02

Credit: 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Duration of ESE : 3 Hrs.

Minimum Eight Experiments to be performed covering the Entire Syllabus of EEU303 Electrical Measurement and Instrumentation. Representative list is as follows,

1. To study LVDT.
2. To measure three phase power by two-wattmeter method.
3. Calibration of three-phase energy meter at unity power factor.
4. Measurement of capacitance by Desauty method.
5. Measurement of inductance by Maxwell inductance Capacitance Bridge.
6. Measurement of High resistance by loss of charge method.
7. Calibration of single-phase energy meter at load having UPF, 0.5 lag and 0.5 lead.
8. Measurement of low resistance by Kelvin's double bridge.
9. To study Megger.
10. To study phase sequence meter.
11. Measurement of temperature, pressure-using strain based pressure transducer.
 - a) Measurement of temperature using thermocouple.
 - b) To study characteristics of RTD, PT 100 transducer.

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.

SHU305 GENERAL PROFICIENCY-II

Teaching Scheme : 01T + 02 P Total: 03

Credit: 02

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks: 50

Presentation Skill:

Communication boosters – aura words, pronunciation, body language – voice, posture and gesture, eye contact, dress codes.

Function of culture code in presentation – planning, preparing and delivering a presentation, etiquettes, clarity and aliveness of delivery.

General communication skill for presentation – content matching and language matching for specific audience, tone, humor poise- listener/speaker sensitivity.

Specific communication skill for presentation – icebreaker, small talk dialogue, debate, turn taking, effective and defensive handling of question.

Models of presentation – Public speaking, academic and professional presentation, group discussion, personal interview, technical report writing (IEEE standards).

Managerial skill:

Time management - advantages, time wasters – procrastination, time management tips and strategies.

Stress management- stress and its disadvantages, stress coping ability and stress inoculation training, management of various types of fear, depression and anger.

Conflict management -types of conflict, conflict stimulation and conflict resolution technique for conflict for effective conflict management, effective ways of dealing with people, significance of body language in communication and assertiveness training.

Interpersonal skills -concept of team, advantages of teamwork, promotion of team spirit, team building techniques, nurturing leadership qualities, negotiation skills.

Topics for assignments/practicals:

1. Minimum eight assignments/practicals based on above topics. The representative list is given below
2. Collection of new words concerning various technical and professional subjects
3. Listening of audiocassette or lecture or watching videocassette (based on the topics of managerial skill) followed by speech/seminar by students.
4. Listening of audiocassette or lecture or watching videocassette (based on the topics of managerial skill) followed by group discussion of students.
5. Collecting the information related to the topics of managerial skill using Internet, books, Magazines etc. and its power point presentation or seminar/lecture.
6. Power point presentation on topic related to any subject of programme.
7. Preparing a technical paper in IEEE format.
8. Management games.
9. Personal interview.
10. Extempore elocution, debate.

Text Books:

1. Professional Communication Skills, Alok Jain, Pravin S. ,R. Bhatia, A. M. Sheikh, 3rd edition, S. Chand and Company, New Delhi, 2005
2. Personality Development, E. B. Hurlock, 5th edition, Tata MacGraw Hill, New Delhi, 2006

Reference Books:

1. Power of Positive Thinking, D. J. Mile, 1st edition, 28th reprint , Rohan Book Company, Delhi, 2004.
2. All About Self motivation, Pravesh Kumar, 3rd edition, Goodwill Publishing House, New Delhi, 2005.
3. Body Language: How to Read Others Thoughts by their Gestures, Pease, Allan, 3rd edition, Sudha Publications. New Delhi, 1998.
4. Multiple Intelligences: The Theory in Practice: A Reader, Gardner, Howard, 1st edition, Basic Books. New York, 1993.
5. Six Thinking Hats, De Bono, Edward, 2nd Edition, Penguin Books, New York, 2000.

SHU401 ENGINEERING MATHEMATICS - IV**Teaching Scheme : 03 L****Total : 03****Credit: 03****Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE****Total Marks: 100****Duration of ESE : 2 Hrs.30 min.**

Complex integration:

Line and contour integration, singular points, expansion of functions in Taylor's and Laurent's series, Cauchy's integral theorem and integral formula, residue theorem, evaluation of real integrals using residue theorem.

Vector spaces:

Vector spaces and subspaces, null spaces, column spaces and linear transformations, linearly independent sets, bases, coordinate systems, dimensions of vector space, change of bases ,application to difference equations.

Orthogonality and least squares:

Inner product, length and orthogonality, orthogonal sets, orthogonal projections, Gram-Schmidt process, least square problems, inner product spaces

Probability:

Introduction to random processes, probability distributions i.e. discrete and continuous distributions, probability density function, Binomial, Poisson, Normal distributions.

Text Books:

1. Text book of applied Mathematics, P.N.Wartikar and J.N.Wartikar, Pune vidyarthi griha, Pune 2001.
2. Linear algebra and its applications, D.C.Lay, 3th edition, Addison Wesley, 2004.
3. Probability & Statistics for Engineers & Scientists, R.E.Walpole, R.H.Myers, S.L.Myers and Keying Ye, 7th edition Pearson Education, 2005.

Reference Books:

1. Advanced Engineering Mathematics, John bird 5th edition, Elsevier publication, 2007.
2. Advanced Engineering Mathematics, Kreyzig, 9th edition, John Wiley Publication, 1995.
3. Linear Algebra with applications, Nicolson, Mc Graw Hill, 2004.
4. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis, S Pillai, McGraw Hill, 2002.
5. Probability, Random Variables and Random Signal Principles, Peyton Z. Peebles, 2nd edition McGraw Hill, 1987.

EEU401 PULSE & DIGITAL CIRCUITS**Teaching Scheme : 03L + 01T Total : 04****Credit : 04****Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE****Total Marks : 100****Duration of ESE : 2 Hrs.30 min.**

Number system and codes: Positional number system – Binary, octal, decimal, hexadecimal, general conversions, arithmetic operations on unsigned and signed numbers, 1's, 2's, 9's, 10's complement method, negative number representation, BCD codes, gray codes, ASCII codes, error detection and correction codes.

Boolean algebra and logic circuits: Logic gates – basic, derived and universal gates, theorems and properties of Boolean algebra, DeMorgan's theorem, canonical and standard SOP and POS forms, simplification and synthesis of Boolean functions up to 4 variables using gates, Boolean theorems, K-Map, don't care condition and Quine McCluskey method.

Digital logic families: Characteristics of digital ICs, study of TTL, ECL, I²L, CMOS logic families, BJT and CMOS as a switch, description and operation of TTL and CMOS logic gates, tristate logic.

Combinational logic design: Arithmetic circuits as half and full adder and subtractor, 4-bit adder / subtractor, IC 7483, BCD adder, digital comparator, multiplexer, demultiplexer, encoder, decoder.

Sequential logic design: One-bit memory cell, S-R, clocked S-R, J-K, master slave J-K, T-type, D-type flip-flops, shift registers, synchronous and asynchronous counters, up/down counters, ripple counters, MOD-n counters.

Semiconductor memories: RAM, ROM, PROM, EPROM, CCD and flash memories. Introduction to CPLD and FPGA.

State machine design approach: State table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples, Designing state machine using ASM charts; Design examples.

Text Books:

- 1) Modern Digital Electronics, R.P. Jain, 3rd edition, Tata Mc-Graw Hill, 2005.
- 2) Digital Electronics-Circuits and Systems, V. K. Puri, 1st edition, Tata McGraw Hill Publications, 2003.
- 3) Digital Principles and Application, A. P. Malvino, D. P. Leach, 6th edition, Tata Mc-Graw Hill, 2006.

Reference Books:

- 1) Digital Electronics, W. H. Gothman, 2nd edition, Prentice Hall India, 2006.
- 2) Digital Logic and Computer Design, M. Morris Mano, 3rd edition, Prentice Hall India Ltd. 2005.
- 3) Digital Principles and Design, D. Givone, 1st edition, Tata Mc-Graw Hill, 2002.
- 4) <http://www.nptel.iitm.ac.in/>
- 5) www.ocw.mit.edu

EEU402 ELECTRICAL MACHINES –I**Teaching Scheme : 03 L****Total: 03****Credit: 03****Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE****Total Marks: 100****Duration of ESE : 2 Hrs.30 min.**

D.C. machines: Construction, principle of operation EMF equation torque equation, Armature winding- Lap, wave single layer double layer, Armature reaction and commutation, method of improving commutation.

D.C. Generators: Types characteristics and application of d.c.shunt, series and compound generators. Parallel operation of D.C. shunt, series and compound generators, Introduction for conducting the tests on D.C. machines as per IS 94320-1979.

D.C. Motors: Characteristics and applications of d.c.shunt, series and compound motors, starting and speed control of motors, Losses and efficiency of motors. Introduction for conducting the tests on D.C. motors as per IS 94320-1979.

Single Phase Transformer: Heat run test separation of core losses into its components Parallel operation equivalent circuit. All day efficiency, conducting the tests on as per Transformer IS 2026-1962.

Autotransformer: Construction working merits demerits and applications.

Three Phase Transformer: Construction, working, types connections, applications testing, parallel operation, Power transformer, Distribution transformer construction.

Three phase to single phase, two phase six phase twelve phase conversion, three winding transformer and tap changing of transformer, Waveforms of no load current and inrush phenomenon.

Text Books:

1. Electrical Machinery, Nagrath Kothari, 4th edition, TMH 2009.
2. Theory of Electrical Machines, Langsdorf, TMH 1999

Reference Books:

1. Electrical engineering Vol.I : Direct Current, Dawes. 4th Edition, PHI, 1998
2. Advance Electrical Technology, H.Cooton, TMH, 1999
3. Electrical Machines Sigma Series, Nagrath and Kothari, TMH 2007
- 4) <http://www.nptel.iitm.ac.in/>
- 5) www.ocw.mit.edu

EEU403 ENERGY RESOURCES & GENERATION

Teaching Scheme : 03 L

Total : 03

Credit : 03

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Thermal and Hydro Power plant: 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.

Nuclear and Diesel Power plant: Methods of producing nuclear reactions, functions of different components of nuclear plant, functions of different components of diesel plant.

Solar Energy and its measurement: 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.

Fuel cells: Chemistry applied to fuel cells, principle and operation, classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cells system.

Wind Energy: 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.

Ocean and tidal energy: 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.

Other Renewable energy resources: 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.

Textbooks:

1. Conventional Energy Technology, S.B.Pandya, Tata Mc-GrawHill 2005.
2. Non Conventional Energy Resources, G.D.Rai, Khanna Publishers 2001.

Reference book:

1. Energy and Atmosphere, I.M.Campbell, Wiley, New York, 2006.
2. Solar Energy, S.P.Sukhatme, Tata Mc-Graw Hill, 2006.
3. Non Conventional Energy Resources, B.H.Khan, Tata Mc-Graw Hill, 2003.
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EEU404 ELECTROMAGNETIC ENGINEERING

Teaching Scheme : 03 L + 01 T Total : 04

Credit : 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Review of vector analysis: Scalars and vectors, vector algebra, the rectangular coordinate systems, vector components and unit vectors, the vector field, the dot product, the cross product, the cylindrical and spherical coordinate system.

Coulombs Law and Electric field intensity: The experimental law of Coulomb, Electric field intensity, field due to continuous volume charge distribution, field of line charge, field of sheet charge, streamlines and sketches of fields.

Electric Flux density, Gauss's Law and divergence: Electric flux density, Gauss's law, and Applications of Gauss's law: some symmetrical charge distributions, differential volume element, and divergence, Maxwell's First Equation (Electrostatics), The vector operator ∇ and the divergence theorem.

Energy and potential : Energy expended in moving a point charge in electric field, the line integral, definition of potential difference and potential, the potential field of a point charge, the potential field of a system of charges, conservative property, potential gradient, The dipole, the potential gradient in the electrostatic field.

Current and conductors : The nature of dielectric materials, the boundary conditions for perfect dielectric materials, capacitance, capacitance of two wire line, using field sketches to estimate capacitance in two dimensional problems, current analogies

Poisson's and Laplace's Equations: Derivations of Poisson's and Laplace's equations, uniqueness theorem, Examples of solution of Laplace's and Poisson's equations, product solutions of Laplace's equation

The steady Magnetic fields: Biot-Savart's Law, Ampere's circuital law, curl, Stoke's theorem, magnetic flux and magnetic flux density, the scalar and vector magnetic potentials, derivations of steady magnetic field laws.

Magnetic forces, materials, and inductance: Force on moving charge, force on a differential current element, and force between differential current elements, force and torque on a closed circuit, the nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, the magnetic circuit, the potential energy and forces on magnetic materials, inductance and mutual inductance.

Time varying magnetic fields and Maxwell's equations: Faraday's laws, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form, the retarded potentials.

Text books:

1. Engineering Electromagnetics, W.H. Hayt, 7th edition, TMH Publication, 2006

Reference books:

1. Electromagnetic Engineering, N.N.Rao, 5th edition, Prentice Hall, 2005.
2. Applied Electromagnetics, Fawwaz T.Ulaby, Prentice Hall, 1999.
3. Electromagnetic Engineering, Krauss, 4th Edition, Tata Mc Graw Hill, 2003.
4. Electromagnetic Waves, Shevgaonkar, Tata Mc Graw Hill 2002.
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

SHU402 ENGINEERING MATHEMATICS LAB

Teaching Scheme : 01 L+ 02 P Total: 03

Credit: 02

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks :50

Duration of ESE : 3 Hrs.

Minimum Eight Experiments to be performed covering the Entire Syllabus of SHU401 Engineering Mathematics - IV. Representative list is as follows,

To be conducted with the help of MatLab/ Mapple (Engineering application).

1. Getting started with (inbuilt demonstrations and help) MatLab/ Mapple
2. Matrix operations, Solution of linear equations, Eigen values and eigen vectors.
3. Differentiation, integration of a single variable function.
4. Solution of Linear differential equation.
5. Solution of system of nonlinear equations (example: Newton Raphson, Secant, etc).
6. Plotting of graphs like bar, pie, line etc with given set of data or of given equations.
7. Infinite series expansion (example: Sine, Cosine, etc).
8. Fourier series and Fourier transform.
9. Z- transform.

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.

EEU406 PULSE & DIGITAL CIRCUITS LAB

Teaching Scheme : 02 P Total: 02

Credit : 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks : 50

Duration of ESE : 3 Hrs.

Minimum Eight Experiments to be performed covering the Entire Syllabus of EEU401 Pulse & Digital Circuits. Representative list is as follows,

1. To study diode as a clipper.
2. To study diode as a clamper.
3. To study RC high pass filter.
4. To study RC low pass filter.
5. To study passive integrator.
6. To study passive differentiator. .
7. To study Transistorized Astable Multivibrator

8. To verify different logic gates.
9. Realization of half adder using gates.
10. Realization of half subtractor using gates.
11. Implementation of full Adder circuit using gates.
12. To study Flip-Flops.
13. To Study counters.

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.

EEU407 ELECTRICAL MACHINES –I LAB

Teaching Scheme : 02 P Total : 02

Credit : 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks : 50

Duration of ESE : 3 Hrs.

Minimum Eight Experiments to be performed covering the Entire Syllabus of EEU402 Electrical Machines –I 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.

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.

EEU408 NUMERICAL METHODS LAB

Teaching Scheme : 02 P Total : 02

Credit : 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks : 50

Duration of ESE : 3 Hrs.

Minimum twelve programming assignments in C/ MATLAB covering complete syllabus. Students shall write and test the programs and submit the report. Representative list is as follows.

1. To obtain root of equation using False Position Method
2. To obtain root of equation using Successive Approximation method
3. To obtain solution of given set of equations using Gauss Seidel method
4. To obtain solution of given set of equations using matrix inversion technique
5. To form Newton's forward difference table and calculate value of variable
6. To form Newton's divide difference table and calculate value of variable
7. To for getting value of variable using Lagrange's method
8. To obtain differentiation using Richardson Extrapolation technique.
9. To obtain differentiation using difference table
10. To obtain integration using Simpson's $1/3^{\text{rd}}$ rule
11. To obtain integration using Gaussian quadrature technique
12. To obtain solution of differential equation using Euler's method
13. To obtain solution of differential equation using 4^{th} order RK method
14. To obtain solution of partial differential equation using Jacobi's method

Note-1 : Course Coordinator shall explain the methods, procedures and algorithm to solve problems. Additional one theory lecture shall be allotted in order to cover the methods theoretically. The department shall provide extra 1 hr/week in time table.

Note-2 :

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.

EEU409 COMPUTATIONAL LAB - I

Teaching Scheme : 02 P Total : 02

Credit : 01

Evaluation Scheme : 25 ICA + 25 ESE

Total Marks : 50

Duration of ESE : 3 Hrs.

This laboratory course is intended to extend the concepts studied in various courses. The students are expected to use Matlab for following topics,

1. Ordinary linear constant coefficient differential equations.
2. Graphical solution of differential equations
3. Matrix and linear algebra problems
4. Solution of system of linear equations with Matlab
5. Laplace transform and Fourier analysis
6. Partial differential equations
7. Probability and statistics
8. Detailed study of symbolic Math toolbox

The term work for this laboratory course will consist of at least 50 programs covering the wide range of topics above.

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.

GOVT. COLLEGE OF ENGINEERING, AMRAVATI



CURRICULUM

B. TECH. (ELECTRICAL)

III and IV Semester

Department of Electrical Engineering
2010-11

ELECTRICAL ENGINEERING DEPARTMENT
B.Tech. (Electrical Engineering)

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem III													
EE301	Engineering Mathematics III	4	1	---	5	10	15	15	60	---	---	100	5
EE302	Electromagnetic Engineering	4	1	---	5	10	15	15	60	---	---	100	5
EE303	Network Analysis	4	---	---	4	10	15	15	60	---	---	100	4
EE304	Electronic Devices and Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE305	Electrical Measurement and Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
EE306	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE307	Electronic Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE308	Electrical Measurement and Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE309	Computational Lab-I *	---	---	2	2	---	---	---	---	50	50	100	2
Total		20	2	8	30	50	75	75	300	125	125	750	27
Sem IV													
EE401	Engineering Mathematics IV	4	1	---	5	10	15	15	60	---	---	100	5
EE402	Pulse & Digital Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE403	Electrical Machines –I	4	---	---	4	10	15	15	60	---	---	100	4
EE404	Energy Resources & Generation	4	1	---	5	10	15	15	60	---	---	100	5
EE405	Numerical Methods	4	---	---	4	10	15	15	60	---	---	100	4
EE406	Pulse & Digital Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE407	Electrical Machines –I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE408	Numerical Methods Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE409	Computational Lab-II **	---	---	2	2	---	---	---	---	50	50	100	2
Total		20	2	8	30	50	75	75	300	125	125	750	27

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem V													
EE501	Communication Engineering	4	1	---	5	10	15	15	60	---	---	100	4
EE502	Electrical Machines -II	4	---	---	4	10	15	15	60	---	---	100	4
EE503	Power System Analysis- I	4	1	---	5	10	15	15	60	---	---	100	5
EE504	Control System I	4	---	---	5	10	15	15	60	---	---	100	5
EE505	Introduction to Microprocessor and Microcontrollers	4	---	---	4	10	15	15	60	---	---	100	4
EE506	Control System I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE507	Electrical Machines -II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE508	Introduction to Microprocessor and Microcontrollers Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE509	General Proficiency - I	---	---	2	2	---	---	---	---	100	---	100	2
Total		20	2	8	30	50	75	75	300	175	75	750	27
Sem VI													
EE601	Signals & Systems	4	1	---	4	10	15	15	60	---	---	100	4
EE602	Power Electronics - I	4	---	---	4	10	15	15	60	---	---	100	4
EE603	Power System Analysis - II	4	---	---	4	10	15	15	60	---	---	100	4
EE604	Optimization Techniques	4	1	---	5	10	15	15	60	---	---	100	5
EE605	Control System – II	4	1	---	5	10	15	15	60	---	---	100	4
EE606	Power Electronics - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE607	Power System Analysis - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE608	Minor Project	---	---	2	2	---	---	---	---	25	25	50	2
EE609	General Proficiency -II	---	---	2	2	---	---	---	---	100	---	100	2
Total		20	3	8	31	50	75	75	300	175	75	750	27

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem VII													
EE701	Linear Integrated Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE702	Power Systems Dynamics	4	1	---	5	10	15	15	60	---	---	100	4
EE703	Power Electronics - II	4	---	---	4	10	15	15	60	---	---	100	4
EE704	Electrical Machine Design	4	----	---	4	10	15	15	60	---	---	100	4
EE705	Elective – I	4	1	---	5	10	15	15	60	---	---	100	5
EE706	Power Electronics - II Lab	----	---	2	2	---	---	---	---	25	25	50	1
EE707	Electrical Machine Design Lab	----	----	2	2	---	---	---	---	25	25	50	1
EE708	Linear Integrated Circuits Lab	----	----	2	2	---	---	---	---	25	25	50	1
EE709	Project and Seminar#	---	---	4	4	---	---	---	---	100	---	100	3
Total		20	2	10	32	50	75	75	300	175	75	750	27
Sem VIII													
EE801	Digital Signal Processing	4	---	---	4	10	15	15	60	---	---	100	4
EE802	Switch Gear and Protection	4	---	---	4	10	15	15	60	---	---	100	4
EE803	Elective – II	4	1	---	5	10	15	15	60	---	---	100	4
EE804	Elective – III	4	1	---	5	10	15	15	60	---	---	100	4
EE805	Switch Gear and Protection Lab	----	---	2	2	---	---	---	---	25	25	50	1
EE806	Digital Signal Processing Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE807	Project and Seminar#	---	---	4	4	---	---	---	---	75	175	250	9
Total		16	2	8	26	40	60	60	240	150	225	750	27

Duration of ESE for all courses is 2 Hrs. 30 Min.

TA :Techer Assesment CT: Class Tests ESE: End Sem.Examination

* Computational LAB-I will contain the introduction to MATLAB and experiments will be based on all subjects

** LAB-II will contain the applications of MATLAB and experiments will be based on all subjects

For project there will be 8 students in each batch (two groups of 4 students)

LIST OF ELECTIVES

Elective I EE705

- A) Power System Operation and Control
- B) Energy Management
- C) Computer Methods in PSA
- D) Power System Reliability
- E) Power Quality and Deregulation

Elective II EE803

- A) HVDC and FACTS
- B) High Voltage Transmission
- C) Power System Design Practice
- D) Power System Transients
- E) High Voltage Engineering

Elective III EE804

- A) Applications of AI Techniques to Power Systems
- B) Network Synthesis using Operational Amplifiers
- C) Artificial Neural Network
- D) Digital Image Processing
- E) Robotics and Automation

EE301 Engineering Mathematics III

Teaching Scheme : 04 L + 01 T Total 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit : 05

Total Marks :100

Linear Differential Equations with constant coefficients:

General solution to L.D.E. of nth order with constant coefficients, rules for finding C.F., General method for finding P.I., P.I. of some standard functions, Method of Variation of Parameters, Cauchy's and Legendre's L.D.E., simultaneous linear differential equations . Applications of L.D.E.: Electrical Circuits, Kirchoff's Law, LCR Circuits, Coupled Electrical Circuits.

Partial Diff. Equations: Definition, formation of P.D.E., complete solution of PDE, Linear and non-linear PDE of types (i) $f(p, q) = 0$, (ii) $f(p, q, z) = 0$, (iii) $f(p, q, x, y) = 0$, (iv) $f(p, q, x, y, z) = 0$ ie Lagrange's form $Pp + Qq = R$ and Clairaut's form $z = px + qy + f(p, q)$, (v) Equations reducible to above forms. Complete solution of PDE of first and second order by method of separation of variables.

Laplace Transform: Definition, standard formulae and properties of LT., Laplace transform of unit step and periodic functions. Laplace Transform of unit impulse function., Inverse Laplace Transform, Convolution Property, Application of LT to solve LDE with constant coefficients.

Vector Calculus: Scalar and vector point functions, Differentiation of a vector function, Tangent and normal components of velocity and acceleration, orthogonal curves, Operator delta, Gradient of scalar point function & their physical meaning . Divergence and Curl of vector point function & their physical meaning. vector identities, solenoidal and conservative fields. Line integral, work done by force.

Functions of complex variables: Analytic function, C-R equations (Cartesian & polar), Harmonic function, Milne Thompson method for finding analytic function, Conformal mappings, Bilinear transformation.

Text Books :

- 1) Text book of applied Mathematics by P.N.Wartikar and J.N.Wartikar, Pune vidyarthi griha, Pune 2001.
- 2) Higher Engineering Mathematics by B.S.Grewal, Khanna publication, 6th edition, New Delhi, 1976.

Reference Books:

- 1) Advanced Engineering Mathematics by Kreyzig, John Wiley & sons 9th edition 1995.
- 2) Advanced Engineering Mathematics by John bird 5th edition Elsevier publication 2007.
- 3) Higher Engineering mathematics by C.R.Wiley, 8th edition John Wiley and sons 1999.

EE302 Electromagnetic Engineering

Teaching Scheme	: 04 L + 01 T	Total 05	Credit : 05
Evaluation Scheme	: 15 CT1 + 15 CT2 +10 TA+ 60 ESE		Total Marks :100
Duration of ESE	: 2 Hrs.30 min.		

Review of vector analysis: Scalars and vectors, vector algebra, the rectangular coordinate systems, vector components and unit vectors, the vector field, the dot product, the cross product, the cylindrical and spherical coordinate system.

Coulombs Law and Electric field intensity: The experimental law of Coulomb, Electric field intensity, field due to continuous volume charge distribution, field of line charge, field of sheet charge, streamlines and sketches of fields.

Electric Flux density, Gauss's Law and divergence: Electric flux density, Gauss's law, and Applications of Gauss's law: some symmetrical charge distributions, differential volume element, and divergence, Maxwell's First Equation (Electrostatics), The vector operator ∇ and the divergence theorem.

Energy and potential : Energy expended in moving a point charge in electric field, the line integral, definition of potential difference and potential, the potential field of a point charge, the potential field of a system of charges, conservative property, potential gradient, The dipole, the potential gradient in the electrostatic field.

Current and conductors : The nature of dielectric materials, the boundary conditions for perfect dielectric materials, capacitance, capacitance of two wire line, using field sketches to estimate capacitance in two dimensional problems, current analogies

Poisson's and Laplace's Equations: Derivations of Poisson's and Laplace's equations, uniqueness theorem, Examples of solution of Laplace's and Poisson's equations, product solutions of Laplace's equation

The steady Magnetic fields: Biot-Savart's Law, Ampere's circuital law, curl, Stoke's theorem, magnetic flux and magnetic flux density, the scalar and vector magnetic potentials, derivations of steady magnetic field laws.

Magnetic forces, materials, and inductance: Force on moving charge, force on a differential current element, and force between differential current elements, force and torque on a closed circuit, the nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, the magnetic circuit, the potential energy and forces on magnetic materials, inductance and mutual inductance.

Time varying magnetic fields and Maxwell's equations: Faraday's laws, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form, the retarded potentials.

Text books:

- | | | |
|-------------------------------------|--------------|----------------------|
| 1. Engineering Electromagnetics 7/e | By W.H. Hayt | TMH Publication 2006 |
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Reference books:

- | | | |
|--|-------------------|-------------------------|
| 1. Electromagnetic Engg. V Edition | By N.N.Rao | Prentice Hall. 2005 |
| 2. Applied Electromagnetics | By Fawwaz T.Ulaby | Prentice Hall. 1999 |
| 3. Electromagnetic Engg. IV Edition | By Krauss | Tata Mc Graw Hill. 2003 |
| 4. Electromagnetic Waves | By Shevgaonkar - | Tata Mc Graw Hill 2002 |
| 5. http://www.nptel.iitm.ac.in/ | | |
| 6. www.ocw.mit.edu | | |

EE303 Network Analysis

Teaching Scheme : 04 L + 00 T Total 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit : 04
Total Marks :100

Terminal Element Relationships: V-I relationship for Inductance and Capacitance- Constant Flux Linkage Theorem and Constant Charge Theorem- v-i relationship for Independent Voltage and Current Sources - v-i relationship for dependent voltage and current sources- Source Functions: unit impulse, unit step, unit ramp and inter relationship, sinusoidal input ,generalized exponential input.

Basic Nodal and mesh Analysis: Introduction, Nodal analysis, the super node, mesh analysis, the super mesh, nodal vs mesh analysis, computer aided circuit analysis using Pspice

Useful circuit analysis techniques: Linearity and superposition, source transformations, Thevinin's theorem , Norton's theorem, Maximum power transfer theorem, Delta-wye transformations

Time Domain Analysis of Circuits: Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-Complete Solution for step/impulse/sinusoid voltage/current inputs-Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of d.c steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution-Solution of two mesh circuits by differential equation method-Determination of initial conditions. Time domain analysis using Pspice

Review of Laplace Transforms: Laplace Transform-Transform Pairs-Gate Functions-Shifting Theorem-Solution of Differential Equations by Laplace Transforms-Initial and Final Value Theorems-Laplace Transforms of periodic signals-Inversion of transforms by partial fractions-Convolution Theorem and Convolution Integral. *(Review to be done by students. No class hour will be spent for this review.)*

Transformation of a Circuit into s-domain: Transformed equivalent of inductance, capacitance and mutual inductance -Impedance and admittance in the transform domain - Node Analysis and Mesh Analysis of the transformed circuit - Nodal Admittance Matrix and Mesh Impedance Matrix in the s-domain - Solution of transformed circuits including mutually coupled circuits-Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots, using Pspice for transform domain analysis

Sinusoidal Steady State analysis: Introduction, characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function, The phasor, phasor relationships for R L C, impedance and admittance , sinusoidal steady state analysis with phasors, pspice for sinusoidal steady state analysis.

Fourier Series: Fourier Series representation of non-sinusoidal periodic waveforms - Fourier Coefficients-Determination of Coefficients-Waveform Symmetry-Exponential Fourier Series-Discrete Amplitude and Phase Spectra-Steady State Solution of Circuits with non-sinusoidal periodic inputs by Fourier Series

Two Port Networks: two port networks-characterizations in terms of impedance, admittance, hybrid and transmission parameters-inter relationships among parameter sets-Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade - Network

Functions-Pole Zero plots and steady state response from pole-zero plots. Use of Pspice for two port networks.

The operational Amplifier: Introduction, the ideal opamp, some basic circuits using ideal opamps, cascaded stages, more detailed model of opamp. Opamp circuits with pspice.

Textbooks :

1. Engineering Circuit Analysis 6/e By Hayt & Kemmerly TataMcgraw Hill 2004

References:-

1. Network Analysis, By M.E. Van Valkenberg PHI 2005
2. Basic Circuit Theory 3/e, By Lawrence P Huelmsan PHI 2001
3. Circuit and Network Analysis By Sudhakar Shyammohan Tata Mc Graw Hill 2005
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE304 Electronic Devices and Circuits

Teaching Scheme : 04 L + 00 T Total 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit : 04
Total Marks :100

Semiconductor Diodes: Semiconductor materials- intrinsic and extrinsic types Ideal Diode, Terminal characteristics of diodes, p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region, Diode small signal model, Zener diode and applications, Rectifier Circuits, Clipping and Clamping circuits

Bipolar Junction Transistors (BJTs) : Physical structure and operation modes, Active region operation of transistor, D.C. analysis of transistor circuits, Transistor as an amplifier, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers, Transistor as a switch: cut-off and saturation modes, High frequency model of BJT amplifier

Field Effect Transistor (FET): Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics, Depletion-type MOSFET, D.C. operation of MOSFET circuits, MOSFET as an amplifier, Biasing in MOSFET amplifiers, Basic MOSFET amplifier configuration: common source, common gate and common drain types, High frequency model of MOSFET amplifier, Junction Field-Effect Transistor (JFET)

Operation Amplifier (Op-amps): Ideal Op-Amp, Differential amplifier: differential and common mode operation, common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non-inverting amplifier, weighted summer, integrator, differentiator, Large signal operation of op-amps, Other applications of op-amps: instrumentation circuits, active filters, controlled sources, logarithmic amplifiers, waveform generators, Schmitt triggers, comparators

Power Circuits and Systems : Class A large signal amplifiers, second-harmonic distortion, Transformer coupled audio power amplifier, Class B amplifier, Class AB operation, Power BJTs, Regulated power supplies, Series voltage regulator, Four layer diodes: p-n-p-n characteristics, Silicon controlled rectifier

Textbooks :

1. Electronics Devices and Circuits By Jacob Millman and Christos C.Halkias, Mc-Graw Hill 2001

References:-

1. Electronics Devices and Circuits By Boylestad R, PHI 2007
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EE305 Electrical Measurement and Instrumentation

Teaching Scheme : 04 L + 00 T Total 04

Credit : 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks :100

Duration of ESE : 2 Hrs.30 min.

Measuring Instruments: Classification, deflecting, controlling, damping, breaking torques. Basic principles of operation of Ammeter & Voltmeter: PMMC, MI, Electro dynamic, Electrostatic: construction, Principle of operation, torque equation, Scale shape, errors, merits & demerits of each type.

Wattmeters & Energy meters: Electro dynamic & Induction type: construction, theory of operation, torque equation, errors & demerits, Electronic energy meter.

Analysis of three phase balanced load, Blondel's Theorem, Measurement of active & reactive power & energy in single phase & three phase circuits.

Instrument Transformer: Need of extension of range: extension using shunt & multipliers Instrument transformers: CT & PT, Theory & construction, Phasor diagram, Ratio & Phase angle error, causes of error, applications Hall effect sensors for voltage and current measurement.

Special Measuring Instruments :- Maximum demand indicator, Trivector meter, Frequency meter, P.F. meter, Phase sequence indicator, Synchroscope, stroboscope, potentiometers.

Measurement of circuit parameters: Different methods of measurement of low, medium & high value of resistance, sensitivity & accuracy of different methods.

AC & DC bridges : Wheatstone, Kelvin, Maxwell, Wein, Hay, Desauty, Anderson, Schearing

Generalized instrumentation system , characteristics of measurement & instrumentation system
Transducers : Definition, classification, specification, selection & loading effect, Displacement, Velocity, force, & Torque transducers, Resistive, Inductive, capacitive, Strain gauge, Piezoelectric, current & voltage transducers.

Transducers for pressure & temperature: Manometer, Elastic members (Bellows, Bourdon tube, Diaphragm), RTD, Thermocouple, Thermister, Infrared & Crystal

Cathode ray oscilloscope: Time, frequency & phase angle measurement using CRO. Spectrum & Wave analyzer.

Text Books:

1. A course in Electrical, Electronics measurement and Instrumentation, By A.K.Sawhney Dhanpat Rai & sons 2006

Reference Books:

- | | |
|--|------------------------------------|
| 1. Electrical measurement and measuring Instruments | By Golding Wheeler Publishing 2003 |
| 2. Electronic measurement and measuring Instruments | By Cooper 1999 |
| 3. Electronic Instrumentation | By H.S. Kalsi TMH 2000 |
| 4. Fundamentals of Electrical Measurements | By C.T.Baldwin 1998 |
| 5. Electrical Measurements | By M.U. Reissland 1997 |
| 6. Instrumentation Measurement & Analysis | By B.C.Nakra & K.K.Chaudhari 2003 |
| 7. http://www.nptel.iitm.ac.in/ | |
| 8. www.ocw.mit.edu | |

EE306 Network Analysis Lab

Teaching Scheme : 02 P Total 02
Evaluation Scheme : 25 Internal + 25 External

Credit: 01
Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE303 Network Analysis. 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 find transmission parameters of two, two port networks connected in cascade.
8. To study the response of RL series circuit to sinusoidal input and dc input (using MATLAB).
9. To study the response of RC series circuit to sinusoidal input and dc input (using MATLAB).

EE307 Electronic Devices and Circuits Lab

Teaching Scheme : 02 P Total 02
Evaluation Scheme : 25 Internal + 25 External

Credit: 01
Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE304 Electronic Devices and Circuits. Representative list is as follows

- 1) To plot the Characteristics of PN junction diode
- 2) To study the half wave rectifier
- 3) To study the center tapped full wave rectifier
- 4) To study bridge full wave rectifier
- 5) To study bridge full wave rectifier with filter
- 6) To plot the characteristics of CE configuration
- 7) To study the transistor as switch
- 8) To study the h parameters of transistors
- 9) To plot frequency response of RC coupled amplifier
- 10) To plot the characteristics of light emitting diode
- 11) To plot the characteristics of Zener diode
- 12) To the field effect transistor.

EE308 Electrical Measurement and Instrumentation Lab

Teaching Scheme : 02 P Total 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE305 Electrical Measurement and Instrumentation. Representative list is as follows

- 1) To study LVDT.
- 2) To measure three phase power by two-wattmeter method.
- 3) Calibration of three-phase energy meter at unity power factor.
- 4) Measurement of capacitance by Desauty method.
- 5) Measurement of inductance by Maxwell inductance Capacitance Bridge.
- 6) Measurement of High resistance by loss of charge method.
- 7) Calibration of single-phase energy meter at load having UPF, 0.5 lag and 0.5 lead.
- 8) Measurement of low resistance by Kelvin's double bridge.
- 9) To study Megger.
- 10) To study phase sequence meter.
- 11) Measurement of temperature, pressure-using strain based pressure transducer.
- 12) a) Measurement of temperature using thermocouple.
b) To study characteristics of RTD, PT 100 transducer.

EE309 Lab Practice-I

Teaching Scheme : 02 P Total 02

Credit: 02

Evaluation Scheme : 50 Internal + 50 External

Total Marks: 100

This laboratory course is intended to introduce the students to software packages like **Matlab/Maple/Scilab**. The instructor may choose any one of the above packages.

Introduction to Matlab – The Matlab environment, the command window, edit window, advantages of Matlab, workspace, getting help

Matlab Basics- variables and arrays, initializing variables in Matlab, subarrays, special values, displaying output data, data files, scalar and array operations, hierarchy of operations, built in Matlab functions, introduction to plotting, simple plots, multiple plots, logarithmic scales

Programming in Matlab:- Good programming practices, relational and logical operators, branches, additional plotting features, loops, while and for loops, programming examples.

User defined functions: - Introduction to Matlab functions, variable passing in Matlab, optional arguments, sharing data using global memory. preserving data between calls to a function, function functions, subfunctions and private functions, input/output functions

Advanced topics :- Brief introduction to GUIs, Handle graphics, designing a simple GUI

The term work for this lab course will consist of at least 50 simple Matlab programs covering the entire syllabus

EE401 Engineering Mathematics IV

Teaching Scheme : 04 L + 01 T Total 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 05

Total Marks: 100

Z-Transform:

Definition, standard forms and properties of Z-transform (i.e. linearity, shifting, multiplication by k and change of scale property), Z-transform of impulse and unit step function, Z-transform of derivatives and integrals, inverse Z-transform. Application of Z-transform to find the solution to difference equations of the first and second order.

Fourier transform:

Complex exponential form of Fourier series, Fourier integral, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transform, inverse Fourier transform.

Vector spaces:

vector spaces and subspaces, null spaces, column spaces and linear transformations, linearly independent sets, bases, coordinate systems, dimensions of vector space, change of bases, application to difference equations. Orthogonality and least squares: Inner product, length and orthogonality, orthogonal sets, orthogonal projections, Gram-Schmidt process, least square problems, inner product spaces.

Complex integration:

Line and contour integration, singular points, expansion of functions in Taylor's and Laurent's series, Cauchy's integral theorem and integral formula, residue theorem, evaluation of real integrals using residue theorem.

Probability:

Introduction to random processes, probability distributions i.e. discrete and continuous distributions, probability density function, Binomial, Poisson, Normal distributions.

Text Books:

- 1) Text book of applied Mathematics by P.N.Wartikar and J.N.Wartikar Pune vidyarthi griha,Pune 2001.
- 2) Higher Engineering Mathematics by B.S.Grewal, khanna publication, new Delhi, 6th edition,1976.
- 3) Linear algebra and its applications by D.C.Lay 3th edition Addison Wesley, 2004.

Reference Books:

- 1) Advanced Engineering Mathematics by John bird 5th edition Elsevier publication 2007.
- 2) Advanced Engineering Mathematics by Kreyzig, 9th edition, John Wiley Publication 1995.
- 3) Linear Algebra with applications by Nicolson, Mc Graw Hill 2004.

EE402 Pulse & Digital Circuits

Teaching Scheme : 04 L + 00 T Total 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit : 04

Total Marks :100

Introduction: Digital Systems; Data representation and coding; Logic circuits, integrated circuits; Analysis, design and implementation of digital systems; CAD tools.

Number Systems and Codes: Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers; Binary coded decimal codes; Gray codes; Error detection and correction codes - parity check codes and Hamming code.

Combinatorial Logic Systems: Definition and specification; Truth table; Basic logic operation and logic gates.

Boolean Algebra and Switching Functions: Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map and Quine-McCluskey tabular methods; Synthesis of combinational logic circuits.

Logic families: Introduction to different logic families; Operational characteristics of BJT in saturation and cut-off regions; Operational characteristics of MOSFET as switch; TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation; Structure and operations of TTL and CMOS gates; Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product.

Combinational Logic Modules and their applications: Decoders, encoders, multiplexers, demultiplexers and their applications; Parity circuits and comparators; Arithmetic modules-adders, subtractors and ALU; Design examples.

Sequential Logic systems: Definition of state machines, state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Timing hazards and races; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines - state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples

State machine design approach: Designing state machine using ASM charts; Designing state machine using state diagram; Design examples

Sequential logic modules and their applications :Multi-bit latches and registers, counters, shift register, application examples.

Text Books :

1. Modern Digital Electronics 3/e By R.P.Jain Tata McGraw Hill, 2003.
2. Fundamentals of Digital Circuits By Anad Kumar Prentice-Hall India, 2003.

Reference Books :

1. Digital Integrated Electronics By Herbert Taub-Donald Schilling TMH 1999
2. Microelectronics By Jacob Millman and Arvin Grabel McGraw Hill 2001
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EE403 Electrical Machines –I

Teaching Scheme : 04 L + 00 T Total 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit : 04
Total Marks :100

D.C. machines: construction ,principle of operation EMF equation torque equation , Armature winding- Lap, wave single layer double layer. Armature reaction and commutation method of improving commutation.

D.C. Generators: Types characteristics and application of d.c.shunt ,series and compound generators. Parallel operation of d.c. shunt ,series and compound generators. Introduction for conducting the tests on d.c. machines as per IS 94320-1979.

D.C. Motors: Characteristics and applications of d.c.shunt ,series and compound motors, starting and speed control of motors. Losses and efficiency of motors. Introduction for conducting the tests on d.c. motors as per IS 94320-1979.

Single Phase Transformer: Heat run test separation of core losses into its components Parallel operation equivalent circuit. All day efficiency.

Conducting the tests on as per Transformer IS 2026-1962

Autotransformer: Construction working merits demerits and applications.

Three Phase Transformer: Construction , working, types connections, applications testing, parallel operation. Power transformer , Distribution transformer construction.

Three phase to single phase ,two phase six phase twelve phase conversion. Three winding transformer and tap changing of transformer. Waveforms of no load current and inrush phenomenon.

Text Books:

- | | | |
|----------------------------------|---------------------|----------|
| 1. Electrical Machinery | By Nagrath Kothari, | TMH 2006 |
| 2. Theory of Electrical Machines | By Langsdorf | TMH 1999 |

Reference Books :

- | | | |
|--|--------------------------|----------|
| 1. Electrical engineering Vol.I : Direct Current 4/e. By Dawes. 1998 | | |
| 2. Advance Electrical Technology | By H.Cooton. 1999 | |
| 3. Substation Equipment | By Satnam and Gupta 2003 | |
| 4. Electrical Machines Sigma Series | By Nagrath and Kothari. | TMH 2007 |
| 5. http://www.nptel.iitm.ac.in/ | | |
| 6. www.ocw.mit.edu | | |

EE404 Energy Resources & Generation

Teaching Scheme : 04 L + 01 T Total 05
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit : 05
Total Marks :100

Thermal and Hydro Power plant: 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.

Nuclear and Diesel Power plant: Methods of producing nuclear reactions, functions of different components of nuclear plant, functions of different components of diesel plant

Solar Energy and its measurement: 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

Fuel cells: Chemistry applied to fuel cells, principle and operation ,classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cells system

Wind Energy: 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, application of wind energy.

Ocean and tidal energy: 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

Other non- conventional energy resources: 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, principle and operation of fuel cells, classification and types of fuel cells, performance characteristics of fuel cells.

Textbooks:

- | | | |
|--------------------------------------|----------------|------------------------|
| 1. Conventional Energy Technology | By S.B.Pandya, | Tata Mc-GrawHill 2005 |
| 2. Non Conventional Energy Resources | By G.D.Rai, | Khanna Publishers 2001 |

Reference book:

- | | | |
|--|------------------|-----------------------|
| 1. Energy and Atmosphere | By I.M.Campbell, | Wiley, New York 2006 |
| 2. Solar Energy | By S.P.Sukhatme, | Tata Mc-GrawHill 2006 |
| 3. Conventional Energy Resources | By B.H.Khan, | Tata Mc-GrawHill 2003 |
| 4. http://www.nptel.iitm.ac.in/ | | |
| 5. www.ocw.mit.edu | | |

EE405 Numerical Methods

Teaching Scheme : 04 L + 00 T Total 04
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE
Duration of ESE : 2 Hrs.30 min.

Credit : 04
Total Marks :100

Solution of Algebraic and Transcendental Equations : Bracketing Methods : Bisection and False Position Methods ,Open Methods : Newton Raphson method, Secant method and Successive approximation method. Comparison of different iterative methods. Implementation of these methods in MATLAB.

Solution of Simultaneous Algebraic Equations : Iterative Methods : Jacobi's method and Gauss-Seidel method. Direct Methods : Gaussian elimination method and matrix inverse method. Finding eigen values of a matrix, determination of largest eigen value. Implementation of these methods in MATLAB.

Interpolation: Evenly spaced points: Formation of forward & backward difference table, Newton's forward and backward difference interpolation formulae.

Unevenly spaced points: Divided difference table and Newton's divided difference interpolation formula, Lagrange's method. Implementation of these methods in MATLAB.

Numerical Differentiation and Integration: Numerical Differentiation: Taylor's series method, Richardson extrapolation method, numerical differentiation using interpolation polynomial (first & second derivative near the beginning & end of the table).

Numerical Integration: Trapezoidal rule, Simpson's rules, Romberg method, Gaussian quadrature method. Implementation of these methods in MATLAB.

Solution of ordinary differential equations : Initial value problem : Taylor's series method, Runge-Kutta methods – second and fourth order, Euler's method, Euler's modified method. Solution of simultaneous and higher order differential equations using Runge-Kutta fourth order method.

Boundary Value problem: Finite-difference method and Cubic-spline method.

Implementation of these methods in MATLAB.

Solution of Partial Differential Equations : Finite difference approximation, elliptical equation (Laplace equation) Jacobie's and Gauss-Seidel method, parabolic equations – explicit and implicit method, hyperbolic equation.

Text Books :

1. Numerical Methods for Engineers 4/e. By Chapra S. S. and Canale R. P, McGraw Hill 2004.

Reference Books :

1. Introductory Methods of Numerical Analysis 4/e By Sastry S. S Prentice Hall. 2002
2. Numerical Methods using MATLAB 4/e By J.H.Mathews & Kurtis D. F. Pearson Education.
3. Applied Numerical Methods in C By Nakamura S Prentice Hall. 2000
4. Computer oriented Numerical Methods By Rajaraman V, Prentice Hall. 1998
5. Numerical Methods with Programming in C and C++ By Veerarajan T. and Ramachandran T Tata McGraw Hill 2006
6. Numerical Methods By Balagurusamy E Tata McGraw Hill. 2007
7. Numerical Methods", 7/e By Faires and Burden Thomson Learning 2000
8. <http://www.nptel.iitm.ac.in/>
9. www.ocw.mit.edu

EE406 Pulse & Digital Circuits Lab

Teaching Scheme : 02 P Total 02
Evaluation Scheme : 25 Internal + 25 External

Credit : 01
Total Marks :50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE402 Pulse & Digital Circuits. Representative list is as follows

1. To study diode as a clipper.
2. To study diode as a clamper.
3. To study RC high pass filter.
4. To study RC low pass filter.
5. To study passive integrator.
6. To study passive differentiator. .
7. To study Transistorized Astable Multivibrator
8. 8)To verify different logic gates.
9. Realization of half adder using gates.
10. Realization of half subtractor using gates.
11. Implementation of full Adder circuit using gates.
12. To study Flip-Flops.
13. To Study counters.

EE407 Electrical Machines –I Lab

Teaching Scheme : 02 P Total 02
Evaluation Scheme : 25 Internal + 25 External

Credit : 01
Total Marks :50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE403 Electrical Machines –I 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.

EE408 Numerical Methods Lab

Teaching Scheme : 02 P Total 02
Evaluation Scheme : 25 Internal + 25 External

Credit : 01
Total Marks :50

Minimum twelve programming assignments in C/ MATLAB covering complete syllabus. Students shall write and test the programs and submit the report. Representative list is as follows.

1. To obtain root of equation using False Position Method
2. To obtain root of equation using Successive Approximation method
3. To obtain solution of given set of equations using Gauss Seidel method
4. To obtain solution of given set of equations using matrix inversion technique
5. To form Newton's forward difference table and calculate value of variable
6. To form Newton's divide difference table and calculate value of variable
7. To for getting value of variable using Lagrange's method
8. To obtain differentiation using Richardson Extrapolation technique.
9. To obtain differentiation using difference table
10. To obtain integration using Simpson's $1/3^{\text{rd}}$ rule
11. To obtain integration using Gaussian quadrature technique
12. To obtain solution of differential equation using Euler's method
13. To obtain solution of differential equation using 4^{th} order RK method
14. To obtain solution of partial differential equation using Jacobi's method

EE409 Lab Practice - II

Teaching Scheme : 02 P Total 02
Evaluation Scheme : 50 Internal + 50 External

Credit : 02
Total Marks :100

This laboratory course is intended to extend the concepts studied in various courses. The students are expected to use Matlab for following topics

- Ordinary linear constant coefficient differential equations.
- Graphical solution of differential equations
- Matrix and linear algebra problems
- Solution of system of linear equations with Matlab
- Laplace transform and Fourier analysis
- Partial differential equations
- Probability and statistics
- Detailed study of symbolic Math toolbox

The term work for this laboratory course will consist of at least 50 programs covering the wide range of topics above.

GOVT. COLLEGE OF ENGINEERING, AMRAVATI



CURRICULUM

B. TECH. (ELECTRICAL) V and VI Semester

**Department of Electrical Engineering
2010-11**

ELECTRICAL ENGINEERING DEPARTMENT
B.Tech. (Electrical Engineering)

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem III													
EE301	Engineering Mathematics III	4	1	---	5	10	15	15	60	---	---	100	5
EE302	Electromagnetic Engineering	4	1	---	5	10	15	15	60	---	---	100	5
EE303	Network Analysis	4	---	---	4	10	15	15	60	---	---	100	4
EE304	Electronic Devices and Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE305	Electrical Measurement and Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
EE306	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE307	Electronic Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE308	Electrical Measurement and Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE309	Computational Lab-I *	---	---	2	2	---	---	---	---	50	50	100	2
Total		20	2	8	30	50	75	75	300	125	125	750	27
Sem IV													
EE401	Engineering Mathematics IV	4	1	---	5	10	15	15	60	---	---	100	5
EE402	Pulse & Digital Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE403	Electrical Machines –I	4	---	---	4	10	15	15	60	---	---	100	4
EE404	Energy Resources & Generation	4	1	---	5	10	15	15	60	---	---	100	5
EE405	Numerical Methods	4	---	---	4	10	15	15	60	---	---	100	4
EE406	Pulse & Digital Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE407	Electrical Machines –I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE408	Numerical Methods Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE409	Computational Lab-II **	---	---	2	2	---	---	---	---	50	50	100	2
Total		20	2	8	30	50	75	75	300	125	125	750	27

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem V													
EE501	Communication Engineering	4	1	---	5	10	15	15	60	---	---	100	4
EE502	Electrical Machines -II	4	---	---	4	10	15	15	60	---	---	100	4
EE503	Power System Analysis- I	4	1	---	5	10	15	15	60	---	---	100	5
EE504	Control System I	4	---	---	5	10	15	15	60	---	---	100	5
EE505	Introduction to Microprocessor and Microcontrollers	4	---	---	4	10	15	15	60	---	---	100	4
EE506	Control System I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE507	Electrical Machines -II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE508	Introduction to Microprocessor and Microcontrollers Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE509	General Proficiency - I	---	---	2	2	---	---	---	---	100	---	100	2
Total		20	2	8	30	50	75	75	300	175	75	750	27
Sem VI													
EE601	Signals & Systems	4	1	---	4	10	15	15	60	---	---	100	4
EE602	Power Electronics - I	4	---	---	4	10	15	15	60	---	---	100	4
EE603	Power System Analysis - II	4	---	---	4	10	15	15	60	---	---	100	4
EE604	Optimization Techniques	4	1	---	5	10	15	15	60	---	---	100	5
EE605	Control System – II	4	1	---	5	10	15	15	60	---	---	100	4
EE606	Power Electronics - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE607	Power System Analysis - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE608	Minor Project	---	---	2	2	---	---	---	---	25	25	50	2
EE609	General Proficiency -II	---	---	2	2	---	---	---	---	100	---	100	2
Total		20	3	8	31	50	75	75	300	175	75	750	27

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory				Practical		Total	
						TA	CT1	CT2	ESE	Internal	External		
Sem VII													
EE701	Linear Integrated Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE702	Power Systems Dynamics	4	1	---	5	10	15	15	60	---	---	100	4
EE703	Power Electronics - II	4	---	---	4	10	15	15	60	---	---	100	4
EE704	Electrical Machine Design	4	----	---	4	10	15	15	60	---	---	100	4
EE705	Elective – I	4	1	---	5	10	15	15	60	---	---	100	5
EE706	Power Electronics - II Lab	----	---	2	2	---	---	---	---	25	25	50	1
EE707	Electrical Machine Design Lab	----	----	2	2	---	---	---	---	25	25	50	1
EE708	Linear Integrated Circuits Lab	----	----	2	2	---	---	---	---	25	25	50	1
EE709	Project and Seminar#	---	---	4	4	---	---	---	---	100	---	100	3
Total		20	2	10	32	50	75	75	300	175	75	750	27
Sem VIII													
EE801	Digital Signal Processing	4	---	---	4	10	15	15	60	---	---	100	4
EE802	Switch Gear and Protection	4	---	---	4	10	15	15	60	---	---	100	4
EE803	Elective – II	4	1	---	5	10	15	15	60	---	---	100	4
EE804	Elective – III	4	1	---	5	10	15	15	60	---	---	100	4
EE805	Switch Gear and Protection Lab	----	---	2	2	---	---	---	---	25	25	50	1
EE806	Digital Signal Processing Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE807	Project and Seminar#	---	---	4	4	---	---	---	---	75	175	250	9
Total		16	2	8	26	40	60	60	240	150	225	750	27

Duration of ESE for all courses is 2 Hrs. 30 Min.

TA :Techer Assesment CT: Class Tests ESE: End Sem.Examination

* Computational LAB-I will contain the introduction to MATLAB and experiments will be based on all subjects

** LAB-II will contain the applications of MATLAB and experiments will be based on all subjects

For project there will be 8 students in each batch (two groups of 4 students)

LIST OF ELECTIVES

Elective I EE705

- A) Power System Operation and Control
- B) Energy Management
- C) Computer Methods in PSA
- D) Power System Reliability
- E) Power Quality and Deregulation

Elective II EE803

- A) HVDC and FACTS
- B) High Voltage Transmission
- C) Power System Design Practice
- D) Power System Transients
- E) High Voltage Engineering

Elective III EE804

- A) Applications of AI Techniques to Power Systems
- B) Network Synthesis using Operational Amplifiers
- C) Artificial Neural Network
- D) Digital Image Processing
- E) Robotics and Automation

EE501 COMMUNICATION ENGINEERING

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Signal & Noise: Signals and its type, electromagnetic frequency spectrum, basics of communication, various base bands, bandwidth of different base band Sources of noise and its types, signal to noise ratio, noise factor, noise figure, noise temperature, noise equivalent temperature, communication systems, wave propagation and its different types, maximum usable frequency (MUF), critical frequency, fading, virtual height, skip distance, single and multi hop transmission, duct propagation.

Amplitude Modulation: Its need and types (only analog modulation), Amplitude Modulation (AM), DSB-SC, SSB, VSB and ISB transmissions, mathematical Analysis, modulation index, frequency spectrum, power requirement of these systems, generation of AM signal.

Angle Modulation: Frequency Modulation (FM), mathematical Analysis, modulation index, frequency spectrum, power requirement of FM, narrowband & wideband FM, noise triangle in FM, pre-emphasis & de-emphasis techniques, phase modulation, power contents of the carrier & the sidebands in angle modulation, noise reduction characteristics of angle modulation, generation of FM signals, comparison between AM & FM.

Receivers: Basic receiver (TRF), Super heterodyne receiver, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AGC technique, AM detectors, FM discriminators, AFC technique, double-spotting effect. Details of each block of AM and FM receiver.

Transmission line: Various parameters of transmission line, their relations, derivation of standing wave ratio, quarter wave transformer, stub matching, Smith chart.

Antenna: Radiation pattern, types of antenna, antenna arrays, turnstile, loop, log -periodic, UHF and microwave (only structure and principle)

Telephony: Basics of land line telephony, working of exchanges local and trunk, basics of integrated service digital network (ISDN), basics of wireless phones such as mobile, cellular, paging system, facsimile.

TEXT BOOKS

1. Principles of Communication Systems (3rd Edition 1995) by Taub, Herbert, Tata McGraw-Hill
2. Electronic Communication Systems (4th Edition 1999) by Kennedy, Devis, Tata McGraw-Hill
3. Electronic communication systems, by Kennedy,Davis ,Tata Mc-Graw Hill

REFERENCE BOOKS

1. Fundamental of communication System(1st edition,2006),by Proakis, Pearson Education
2. Electronic Communication (4th edition) by Roddy and Coolen, Prentice Hall of India, New Delhi 2003
3. Electronic Communication System a Complete Course (4th Edition) by Schweber, PHI, New Delhi 2000
4. Electronic communication, by Shrader, Tata Mc-Graw Hill 2004
5. <http://www.nptel.iitm.ac.in/>

EE502 ELECTRICAL MACHINES -II

Teaching Scheme	: 04 L + 00 T Total 04	Credit: 04
Evaluation Scheme	: 15 CT1 + 15 CT2 +10 TA+ 60 ESE	Total Marks: 100
Duration of ESE	: 2 Hrs.30 min.	

Fundamental of AC rotating machines: AC windings integral slots, fractional slots & fractional pitch winding. Distribution factor , pitch factor, winding factor- harmonic mmf of distributed windings, EMF equation.

Synchronous generators: constructional details, armature circuit reaction model and phasor diagram of salient and non- salient pole machines- determination of parameters of circuit models-methods of determining regulation and efficiency . transient & sub- transient reactances. Methods of synchronization- synchronous machine on infinite busbars-parallel operation

Synchronous Motor: Principle of operation, torque equation, V curves- hunting and damping starting applications.

Three phase induction motor: rotating magnetic fields, principles of operation-constructional details-circuit models and phasor diagram, performance equations-direct and indirect testing-circle diagram. Methods of starting and speed control of 3 phase IM-double cage motor-methods of braking-single phasing, cogging and crawling. Introduction to Induction Generator,

Single phase IM: different types-starting methods-characteristics and application.

AC Commutator machines: series motors-characteristics and application.

d-q transformation of three phase induction motor.

TEXT BOOKS

1. Theory of AC Machines : A.S. Langsdorf(McGraw Hill). 2004
2. Electrical Machines : Nagrath and Kothari(Tata McGraw Hill). 2003

REFERENCE BOOKS

1. Performance and Design of AC Commutator Motor :Openshov-Taylor(McGraw Hill) 2000
2. Performance and Design of Alternating Current Machines : M.G. Say. 1999
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EE503 POWER SYSTEM ANALYSIS- I

Teaching Scheme	: 04 L + 01 T Total: 05	Credit: 05
Evaluation Scheme	: 15 CT1 + 15 CT2 +10 TA+ 60 ESE	Total Marks: 100
Duration of ESE	: 2 Hrs.30 min.	

Transmission line parameters : calculation of resistance, inductance and capacitance of single phase and three phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on inductance and capacitance, interference with communication lines.

Electrical characteristics of transmission line : V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal π and equivalent T representations, Ferranti effect, corona phenomenon, effect of corona and power loss due to corona.

Representation of power systems component: Single phase representation of balanced three phase system, Single line impedance or reactance diagrams. Per unit system: Basic concept, p.u representation of power systems components

Performance of transmission line: receiving and sending end power circle diagrams, methods of voltage control and power factor improvement, use of static VAR generators and synchronous phase modifiers, analytical and graphical methods, automatic voltage control.

Load flow studies : load flow problem, classification of buses, network modeling, Y-bus and Z-bus matrices, load flow equation, GS and NR methods, comparison of methods used.

Insulator : materials used, types of insulators, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, guarding rings and arcing horns.,

Mechanical design: line supports for LV, HV and EHV, Sag calculation, stringing charts.

Underground Cables: Materials used for conductors and insulator, different types of cables comparison of Overhead conductors and Underground cables

TEXT BOOKS

1. Electric Energy Systems Theory: An Introduction, O. L. Elgerd – Second edition, McGraw-Hill Book Comp. N. Y. 1987
2. Elements of Power System Analysis , Stevenson, Tata- Mc-Graw Hill Publishing Company, New Delhi. 2001

REFERENCE BOOKS

1. Power System Analysis, Hadi Saadat McGraw Hill. -2003
2. Modern Power System Analysis, J. Nagrath & D. P. Kothari Tata- Mc-Graw Hill Publishing Company, New Delhi. 2001
3. Electrical Power Systems, C. L. Wadwa Wiley Eastern Limited, New Delhi 2004
4. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems. Narain G. Hingorani and Lazlo Gyugyi -2000
5. Flexible AC transmission Systems (FACTS), Yong Hua Song and Allan T. Johns 2005
6. T and D reference book” Westing house. 2003
7. Electric Power System , B.M.Weedy John Willy and Sons Student Edition 2005
8. <http://www.nptel.iitm.ac.in/>
9. www.ocw.mit.edu

EE504 CONTROL SYSTEM-I

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Introduction to automatic control : open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs.

Effect of feed back on sensitivity to parameter variation and reduction of the noise.

Control System Components: Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchors, potentiometers, tachogenerators, Switch Reluctance Motor (SRM) their functional analysis and operating characteristics and their application. Pneumatic controls devices.

Time response analysis : time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series.

Approximate methods for higher order system, proportional, derivative and integral control.

Stability Analysis : stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability.

Root Locus : construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Frequency response methods : frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response. Nyquist criterion, Nyquist plots Stability analysis from frequency response

TEXT BOOKS

1. Control System Engineering, Nagrath I.J., Gopal M Wiley Eastern.-2008
2. Automatic Control Systems, Kuo B.C Prentice Hall of India.-2000

REFERENCE BOOKS

1. Control Systems, Naresh Sinha Wiley Eastern Limited, New Delhi. 2005
2. Modern Control Engineering , D.Roy Choudhary Prentice Hall of India Pvt Ltd. New Delhi. 2001
3. Modern Control Engineering , 4 th Edition K. Oghata ,Pearson Education 2004
4. Control System Engineering ,Second Edition Norman Nise Addison Wesley Pub. Company 2002
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EE505 INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLERS

Teaching Scheme : 04 L + 00 T Total: 04

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Introduction to microprocessor: 8085: Architecture, register structure, addressing modes. Instruction set of 8085, timing diagrams Assembly Language Programming of 8085, counters and time delays, stack and subroutines Memory mapped I/O and I/O mapped I/O, address decoding techniques, Interrupt system of 8085 (software and hardware interrupts). Data transfer schemes, serial data transfer through SOD and SID line

Interfacing Devices (I): Internal architecture and programming of PPI (8255), PIC (8259), USART (8251)

Interfacing Devices (II): architecture and programming of programmable interval timer (8253), floppy disc controller (8272), programmable CRT controller (8275), DMA controller (8237).

Introduction to architecture 8086: addressing modes, register structure (Assembly Language Programs not required)

Introduction to microcontroller: 8051 architecture, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory, comparative study 8051 families by different manufacturers, study of instruction set of 8051.

TEXT BOOKS

- 1) Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar PHI Publication -2006
- 2) Introduction to Microprocessor L.Gibson, Prentice-Hall 2003
- 3) The 8051 Microcontroller Scott MacKenzie Prentice-Hall, Inc -2006

REFERENCE BOOKS

1. An Introduction to Microcomputers Volume 1 Basic Concepts, Adam Osborne Osborne-McGraw Hill, Berkeley California, 1980
2. The 8051 Family of Microcontrollers Richard Barnett Prentice-Hall, Inc -2005
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EE506 CONTROL SYSTEM-I LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE504 CONTROL SYSTEM-I Representative list is as follows

1. To determine transfer function of given D.C. generator
2. To determine transfer function of armature controlled D C servomotor
3. To plot characteristics of Synchro transmitter.
4. To plot characteristics of Synchro receiver
5. To study potentiometers as error detector
6. To study of different type stepper motor.
7. To determine closed loop response of first order system
8. To determine closed loop response of second order system
9. To plot frequency response of given lead compensator
10. Use MATLAB to
 - a. Plot root locus of transfer function
 - b. Choosing value of K from root locus
 - c. Determine closed loop response of the system
11. To obtain Bode plot using MATLAB
12. Use **MATLAB** to obtain Nyquist plot & there from obtain gain & phase margin for given system

EE507 ELECTRICAL MACHINES –II LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE502 ELECTRICAL MACHINES -II 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 X_d and X_q 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)

EE508 INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLERS LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE508 INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLERS Representative list is as follows

- 1) To give brief description of Architecture of 8085
- 2) To write different addressing modes of 8085
- 3) To add two 8-bit numbers and check flag registers
- 4) To add two 16-bit numbers and check flag registers
- 5) To multiply two 8-bit numbers
- 6) To divide two 8-bit numbers
- 7) To display HELP, character by character after one second delay
- 8) To check parity of a 8-bit number

EE509 GENERAL PROFICIENCY - I

Teaching Scheme : 02 P Total: 02

Credit: 02

Evaluation Scheme : 100 Internal + 00 External

Total Marks: 100

Communication: Need, importance, types and objectives, communication process, barriers, principles of effective communication, modes of communication

Practice of effective communication through eye contact, voice modulation, audience awareness, presentation plan and non-verbal language, face to face conversation, self-analysis.

Understanding guidelines for telephonic conversation, making and receiving calls and telephone messages.

Interviews for Employments: Preparing self and reporting for sample questions on educational background, co-curricular activities, extra curricular activities, and experience and general knowledge, miscellaneous. Case study of Employment oriented Bio Data Profile and Case study of Planning and execution of organizing extra curricular activities in institute.

Data Collection: Role of communication in organizations around and experience sharing by the students. Data collection and report on latest events in Amravati city.

Group Discussion: Seminars and conferences, Understanding different aspects- experience sharing and reporting. Case study of report writing of organizing a seminar/ conference

Paragraph Writing: Understanding principles and general hints writing and analyzing paragraph writing on 3 to 5 topics. Case study on paragraph writing on latest themes on different topics of engineering.

Report Writing and Drafting: Understanding the principles and practices of office drafting such as circulars, notices, memos and telex/ telegraph/ fax/e-mail messages. Case study of report writing on organizing a meeting with Principal / HOD of institute. Report writing on industrial visits

TEXT BOOKS

1. Developing Communication Skills, Krishna Mohan and Meera Banerjee, McMillan Publishers.-2004
2. A Course in Listening and Speaking II, V. Sasikumar, P.Kiranmani Dutt and Geeta Rajeevan, Cambridge University Press. 2000
3. English for Science and Technology, Thiruvankataswami and Kiranmani Dutt, Cambridge University Press.- 2004

EE601 SIGNALS & SYSTEMS

Teaching Scheme : 04 L + 01 T Total: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

Extensive use of MATLAB should be done for imparting instructions

Introduction to Signals and Systems: Signals and Systems, Classification of Signals Classification of Systems, Systems Modeling Some Ideal Signals, Energy and Power Signals Frequency Response, Discrimination of Continuous-Time Signals Topological Models, Analysis of Continuous-Time Systems Time Domain and Frequency Domain, Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems. Fourier series and Its Properties Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Ideal Low-Pass Filter Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete-Time Sequences Linear Convolution, Discrete-Time System Response

Sampling: Representation of a continuous-Time Signal by its Samples; The Sampling Theorem; Reconstruction of Signals from its Samples using Interpolation; Effect of Under Sampling (Frequency Domain Aliasing); Discrete Time processing of Continuous-Time Signals

The Z Transform: The Z Transform; The Region of Convergence for the Z- Transform; Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot; Properties of Z- Transform; Analysis and Characterization of Discrete-Time LTI Systems using Z-Transform; System Transfer Function; Block Diagram Representation; The Unilateral Z-Transform; Solution of Difference Equation using the Unilateral Z-Transform.

Discrete Fourier Transform and Fast Fourier Transform Representation of Discrete-Time aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform. Fast Fourier Transform (FFT)

TEXT BOOK

1. Signals And Systems , S.Haykin, 2nd Edition, John Wiley And Sons 1999
2. Analog And Digital Signal Processing , Ambardar A, 2/3; Thomson Learning-2005

REFERENCE BOOKS

1. Signals and systems, Oppenheim and Schaffer Prentice Hall India Of India 2nd Edition 1997
2. Signal & System: Analysis using , Transform Method and Matlab by M.J.Roberts, McGraw Hill company Ltd 2nd Edition 2003
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EE602 POWER ELECTRONICS - I

Teaching Scheme : 04 L + 00 T Total: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

SCR, triac, diac-construction, characteristics & applications, two transistor analogy for turning ON-OFF SCR, turn ON mechanism, different methods of turning ON-OFF SCR, turn OFF mechanism, thyristor firing circuits-R,R-C & UJT, introduction to GTO, power transistor, power MOSFET & IGBT their construction & characteristics.

Series -parallel operation of SCRs, series and parallel operation, static & dynamic equalising ckts., equalisation of current in parallel connected SCRs, string efficiency, derating factor, protection of SCRs against di/dt , dv/dt , radio freq. interference, over voltage, over current.

Principle of phase control, half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of free wheeling diode, single phase dual converters.

Classification of ckt. for forced commutation, series inverter, improved series inverter, parallel inverter, out put voltage and waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorized bridge inverter.

Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, and AC chopper. Buck and boost converter. Basic principle of cycloconverters, single phase to single phase cycloconverter, voltage regulators.

TEXT BOOKS

1. Power Electronics Circuits Devices and Application, M.H.Rashid Prentice Hall of India (PHI) Pvt. Ltd., New Delhi.-2003
2. An Introduction to Thyristors and their Application, M.Ramamoorthy Affiliated East West Pvt. Ltd., New Delhi. 1999

REFERENCE BOOKS

1. Power Electronics, P.C.Sen TMH Publication Co. Ltd., New Delhi. 2003
2. Thyristorised Power Controllers, G.K.Dubey, S.R.Doradia, A.Joshi, R.M.Sinha New Age International, New Delhi 2004
3. Power Electronics: Converters, Applications and Design (3rd edition) Ned Mohan Tore M. John Wiley & Sons Inc 2002
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE603 POWER SYSTEM ANALYSIS - II

Teaching Scheme : 04 L + 00 T Total: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

Symmetrical Fault Analysis

Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation

Symmetrical components

Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank- sequence voltages and currents relationship; power system elements – sequence impedance and sequence networks ; Various three phase transformer connections – zero sequence rules; Unbalanced load system – application.

Unsymmetrical Fault Analysis

L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults- loaded and unloaded conditions.

Power system Stability

Introduction, Power angle equation, Steady state stability , Transient Stability , Equal Angle criteria .Numerical solution of Swing Equation , Introduction to Voltage stability.

HVDC : HVDC Transmission Basic principle, Transmission equipments, Comparison with AC links, Inverters – reactive power requirement; Converters, DC links, Circuit breaking, ground return, Economic distance, modern developments.

Reactive power compensation and concept of FACT devices

TEXT BOOKS

3. Electric Energy Systems Theory: An Introduction, O. L. Elgerd – Second edition, McGraw-Hill Book Comp. N. Y. 1987
4. Elements of Power System Analysis , Stevenson, Tata- Mc-Graw Hill Publishing Company, New Delhi. 2001

REFERENCE BOOKS

10. Power System Analysis, Hadi Saadat McGraw Hill. -2003
11. Modern Power System Analysis, J. Nagrath & D. P. Kothari Tata- Mc-Graw Hill Publishing Company, New Delhi. 2001
12. Electrical Power Systems, C. L. Wadwa Wiley Eastern Limited, New Delhi 2004
13. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems. Narain G. Hingorani and Lazlo Gyugyi -2000
14. Flexible AC transmission Systems (FACTS), Yong Hua Song and Allan T. Johns 2005
15. T and D reference book” Westing house. 2003
16. Power System Stability and Control, Prabha Kundur Mc-Graw Hill Publishing Company, New Delhi. 2003
17. Power System Analysis and Design J.Dunchan Glover ,M.S.Sharma, Cengage Learning 2008.
6. <http://www.nptel.iitm.ac.in/>
7. www.ocw.mit.edu

EE604 OPTIMIZATION TECHNIQUES

Teaching Scheme : 04 L + 01 T Total: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 05

Total Marks: 100

Introduction: engineering applications of optimization, statement of an optimization problem, optimization techniques, classical optimization problem, optimization techniques. Classical optimization techniques - single and multi variable optimization with and without constraints.

Linear programming I - standard form, definitions and theorems, graphical method, solution of system of linear simultaneous equations, simplex method, two phase simplex method, revised simplex method.

Linear programming II - duality, theorems on duality, dual simplex method, decomposition principle, sensitivity analysis, balanced and unbalanced transportation problems.

Non linear programming - unimodal function, unrestricted search, Fibonacci search method and Golden section method, unconstrained optimization, direct search methods - pattern search methods, simplex method, descent method - steepest descent method, conjugate gradient and variable metric method.

Dynamic programming: multistage decision processes, principle of optimality, sub optimization, calculus and tabular method of solution, conversion of final value problem into initial value problem, solution of linear programming. Continuous dynamic programming.

TEXT BOOKS

1. Optimization - Theory & Application, S.S.Rao Wiley Eastern Ltd.2005
2. Operations Research, H.A.Taha PHI, New Delhi.-2000

REFERENCE BOOKS

1. Introduction Operations Research, Fredrick S.Hiller Gerald J.L. Lieberman Tata McGraw Hill Pub. Co., New Delhi.-2004
2. Introduction to Optimization, J.C.Pant Jain Brothers, New Delhi.-2001
3. PERT and CPM Principles & Application, L.S.Srinath Affiliated East West Pvt. Ltd., New Delhi.-2006
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE605 CONTROL SYSTEM – II

Teaching Scheme : 04 L + 01 T Total : 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

Compensation Techniques: Introduction, Preliminary considerations of Classical Design, Lead Compensator, Lag Compensator, Lag- Lead Compensator, Cascade Compensation in time domain, Cascade compensation in Frequency domain, Feedback compensation in frequency domain .

State Space Techniques I: State, state space and state variables; SISO/MIMO linear systems state variable models - differential equations, Transfer Functions, Block Diagrams and State Diagrams (Signal Flow Graphs); Transfer functions decomposition - Phase variable forms, Canonical forms and Jordan canonical form; Transfer function - state model; Transfer matrix; State equations solution - State transition matrix (STM); STM Computation – Laplace transformation, Canonical transformation and Cayley Hamilton theorem; Time response – SISO Systems.

State Space Techniques II: Concept - controllability and observability; SISO/MIMO Linear systems -Gilbert's method and Kalman's test; SISO controllable systems Design -state feedback.

Sampled Data Control Systems: Representation, Z Transforms. review, Sampler and Hold - zero order hold; Sampling theorem; Z Transform analysis – open loop and closed loop sampled data systems, Z Transfer functions, Difference equation solution and response; Z Transform Method,. Discrete Systems Response, Open and closed loop systems pulse transfer functions - Different sampler locations; Digital Controller - transfer function; Stability analysis - S and Z Domain relationship, Jury's Test and Bi-Linear Transformation, Root and root locus method.

Non-Linear System Analysis I :Non-linear system behavior – types and characteristics; Describing functions - typical non-linearity and their characteristics; Stability analysis - Describing function method and Limit cycles; Limitations - describing function method.

Non-Linear System Analysis II Linearization - Around operating point; Singular points – Classification and Nature; Phase-plane method - non- linear systems analysis; Phase trajectories construction – analytical method and graphical method by isocline method; Stability analysis - limit cycle; Limitations - phase-plane method.

TEXT BOOKS:

1. Control System Engineering, Wiley I.J. Nagrath and M. Gopal Eastern Limited, New Delhi.
2. Modern Control Theory, K . Ogata Prentice Hall of India Pvt. Ltd. New Delhi.

REFERENCE BOOKS:

7. Control System Engineering ,Second Edition Norman Nise Addison Wesley Pub. Company 2002
8. D.Roy Choudhary –Modern Control Engineering , Prentice Hall of India Pvt Ltd. New Delhi.
9. Automatic Control System, B. C. Kuo Prentice Hall of India Pvt Ltd. New Delhi.
10. <http://www.nptel.iitm.ac.in/>
11. www.ocw.mit.edu

EE606 POWER ELECTRONICS - I LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE602 POWER ELECTRONICS - I Representative list is as follows

- 1) To study the characteristic of SCR
- 2) To study the characteristic of TRIAC
- 3) To study the Half controlled converter
- 4) To study the full controlled converter
- 5) To study the Triggering method of SCR
- 6) To study the parallel inverter
- 7) To study the series inverter
- 8) To study the step down and step up choppers
- 9) To study the voltage controlled using triac

EE607 POWER SYSTEM ANALYSIS - II LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

Minimum Eight Experiments to be performed covering the Entire Syllabus of EE603 POWER SYSTEM ANALYSIS - II Representative List is as follows

1. To study the transmission line system training simulator
2. To find out efficiency and Regulation of transmission line with out compensation.
3. To study current limiting Reactors.
4. To determine A,B,C,D parameters by o.c & s.c. test
5. To find out transmission line parameters A,B,C,D. & Prove $AD-BC = 1$
6. To find out efficiency and Regulation of transmission line with shunt compensation.
7. To study surge impedance loading (SIL)
8. To study Ferranti effect
9. To study power World Simulator specific focus on Load flow study and Stability analysis.

EE608 MINI PROJECT

Teaching Scheme : 02 P Total: 02

Credit: 02

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

For minor project group of for students is to be formed. Innovative ideas of students are expected to be implemented in hardware or software projects. Two groups will be assigning to each guide so that the same students will come for the main project of final year.

EE609 GENERAL PROFICIENCY - II

Teaching Scheme : 02 P Total: 02
Evaluation Scheme : 100 Internal + 00 External

Credit: 02
Total Marks: 100

Planning: Nature, importance, functions, types of plans, strategic decision making, types of decisions, business forecasting, types and techniques of forecasting. Case study of different forecasting techniques

Leadership and Organizational Structure: Characteristic, styles, types, qualities of leadership, Case study of Leadership styles and organizational structures in different organizations

Human Resources Management: Human resources planning, recruitment, selection, training and development, motivation, employee welfare, safety and health, trade unions and industrial relations. Case study of HRM in government and non-government organizations

Negotiation: Concept, types, Different types of MoU agreements and different contents. Case study of MoU agreement between 2 agencies / organizations

R and D Projects: Different types of research projects and funding agencies, their eligibility criteria, different types of formats. Case study of different funding agencies and different types of research projects funding

Finance Management in Industries: Different types of financing institutions and their funding agencies, financial management, Case study of financing procedures and schemes for SSI / SMEs

TEXT BOOKS/WEBSITES:

- 1) Dynamics of Personnel Management in India, R D Agrawal, Tata McGraw Hill Pub Co, New Delhi, 2005.
- 2) Personnel Management: Edwin B Flippo : McGraw Hill International Edition, New Delhi , 2003.
- 3) The Spirit of Leadership: Harrison Owen: Tata McGraw Hill Pub. Co, New Delhi 2005.
- 4) [www: aicte.ernet.in](http://www.aicte.ernet.in)
- 5) www.ugc.ac.in
- 6) www.dst.gov.in
- 7) www.ntmis-dst.org
- 8) www.isro.org
- 9) www.vichar.nic.in
- 10) www.serc-dst.org

GOVT. COLLEGE OF ENGINEERING, AMRAVATI



CURRICULUM

B. TECH. (ELECTRICAL) VII and VIII Semester

**Department of Electrical Engineering
2010-11**

ELECTRICAL ENGINEERING DEPARTMENT
B.Tech. (Electrical Engineering)

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem III													
EE301	Engineering Mathematics III	4	1	---	5	10	15	15	60	---	---	100	5
EE302	Electromagnetic Engineering	4	1	---	5	10	15	15	60	---	---	100	5
EE303	Network Analysis	4	---	---	4	10	15	15	60	---	---	100	4
EE304	Electronic Devices and Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE305	Electrical Measurement and Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
EE306	Network Analysis Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE307	Electronic Devices and Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE308	Electrical Measurement and Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE309	Computational Lab-I *	---	---	2	2	---	---	---	---	50	50	100	2
Total		20	2	8	30	50	75	75	300	125	125	750	27
Sem IV													
EE401	Engineering Mathematics IV	4	1	---	5	10	15	15	60	---	---	100	5
EE402	Pulse & Digital Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE403	Electrical Machines –I	4	---	---	4	10	15	15	60	---	---	100	4
EE404	Energy Resources & Generation	4	1	---	5	10	15	15	60	---	---	100	5
EE405	Numerical Methods	4	---	---	4	10	15	15	60	---	---	100	4
EE406	Pulse & Digital Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE407	Electrical Machines –I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE408	Numerical Methods Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE409	Computational Lab-II **	---	---	2	2	---	---	---	---	50	50	100	2
Total		20	2	8	30	50	75	75	300	125	125	750	27

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
						Theory				Practical		Total	
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	CT1	CT2	ESE	Internal	External		
Sem V													
EE501	Communication Engineering	4	1	---	5	10	15	15	60	---	---	100	4
EE502	Electrical Machines -II	4	---	---	4	10	15	15	60	---	---	100	4
EE503	Power System Analysis- I	4	1	---	5	10	15	15	60	---	---	100	5
EE504	Control System I	4	---	---	5	10	15	15	60	---	---	100	5
EE505	Introduction to Microprocessor and Microcontrollers	4	---	---	4	10	15	15	60	---	---	100	4
EE506	Control System I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE507	Electrical Machines -II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE508	Introduction to Microprocessor and Microcontrollers Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE509	General Proficiency - I	---	---	2	2	---	---	---	---	100	---	100	2
Total		20	2	8	30	50	75	75	300	175	75	750	27
Sem VI													
EE601	Signals & Systems	4	1	---	4	10	15	15	60	---	---	100	4
EE602	Power Electronics - I	4	---	---	4	10	15	15	60	---	---	100	4
EE603	Power System Analysis - II	4	---	---	4	10	15	15	60	---	---	100	4
EE604	Optimization Techniques	4	1	---	5	10	15	15	60	---	---	100	5
EE605	Control System – II	4	1	---	5	10	15	15	60	---	---	100	4
EE606	Power Electronics - I Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE607	Power System Analysis - II Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE608	Minor Project	---	---	2	2	---	---	---	---	25	25	50	2
EE609	General Proficiency -II	---	---	2	2	---	---	---	---	100	---	100	2
Total		20	3	8	31	50	75	75	300	175	75	750	27

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory				Practical		Total	
						TA	CT1	CT2	ESE	Internal	External		
Sem VII													
EE701	Linear Integrated Circuits	4	---	---	4	10	15	15	60	---	---	100	4
EE702	Power Systems Dynamics	4	1	---	5	10	15	15	60	---	---	100	4
EE703	Power Electronics - II	4	---	---	4	10	15	15	60	---	---	100	4
EE704	Electrical Machine Design	4	----	---	4	10	15	15	60	---	---	100	4
EE705	Elective – I	4	1	---	5	10	15	15	60	---	---	100	5
EE706	Power Electronics - II Lab	----	---	2	2	---	---	---	---	25	25	50	1
EE707	Electrical Machine Design Lab	----	----	2	2	---	---	---	---	25	25	50	1
EE708	Linear Integrated Circuits Lab	----	----	2	2	---	---	---	---	25	25	50	1
EE709	Project and Seminar#	---	---	4	4	---	---	---	---	100	---	100	3
Total		20	2	10	32	50	75	75	300	175	75	750	27
Sem VIII													
EE801	Digital Signal Processing	4	---	---	4	10	15	15	60	---	---	100	4
EE802	Switch Gear and Protection	4	---	---	4	10	15	15	60	---	---	100	4
EE803	Elective – II	4	1	---	5	10	15	15	60	---	---	100	4
EE804	Elective – III	4	1	---	5	10	15	15	60	---	---	100	4
EE805	Switch Gear and Protection Lab	----	---	2	2	---	---	---	---	25	25	50	1
EE806	Digital Signal Processing Lab	---	---	2	2	---	---	---	---	25	25	50	1
EE807	Project and Seminar#	---	---	4	4	---	---	---	---	75	175	250	9
Total		16	2	8	26	40	60	60	240	150	225	750	27

Duration of ESE for all courses is 2 Hrs. 30 Min.

TA :Techer Assesment CT: Class Tests ESE: End Sem.Examination

* Computational LAB-I will contain the introduction to MATLAB and experiments will be based on all subjects

** LAB-II will contain the applications of MATLAB and experiments will be based on all subjects

For project there will be 8 students in each batch (two groups of 4 students)

LIST OF ELECTIVES

Elective I EE705

- A) Power System Operation and Control
- B) Energy Management
- C) Computer Methods in PSA
- D) Power System Reliability
- E) Power Quality and Deregulation

Elective II EE803

- A) HVDC and FACTS
- B) High Voltage Transmission
- C) Power System Design Practice
- D) Power System Transients
- E) High Voltage Engineering

Elective III EE804

- A) Applications of AI Techniques to Power Systems
- B) Network Synthesis using Operational Amplifiers
- C) Artificial Neural Network
- D) Digital Image Processing
- E) Robotics and Automation

EE701 LINEAR INTEGRATED CIRCUITS

Teaching Scheme : 04 L + 00 T Total: 04

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Op-amp Fundamentals: Differential amplifiers, ac and dc analysis of differential amplifiers, review of operation amplifier- block diagram representation, basic configurations, ideal op-amp, negative feedback, non – ideal closed loop characteristics.

Basic op-amp Circuits: voltage follower, sign changer, adder, subtractor etc, I to V and V to I converters, current amplifiers, difference amplifiers, instrumentation amplifiers and their applications, transducer bridge amplifier.

Op-amp Parameters: Input bias and offset current, input offset voltage, input offset error compensation, slew rate, common mode rejection ratio etc, frequency response, input and output impedance, operation limits, compensated and uncompensated op-amps, compensation techniques.

Non-linear Circuit Applications: Voltage comparator and its applications, Schmitt trigger and its application, precision rectifiers, limiters, analog switches, peak detectors, sample and hold circuits, integrator and differentiator, log/antilog amplifiers, practical log/antilog circuits, analog multipliers, op-amp as phase detector, op-amp electronic thermometers.

Active Filters: Classification, transfer function, butter worth filters. low pass, high pass, band pass, band stop, notch and all pass.

Timer: IC 555, functional diagram, monostable and astable multivibrator.

Voltage regulators: Series op-amp regulators, IC voltage regulators, switching regulators etc, IC 723.

Text Books

1. Op-amps and Linerar Integrated Circuits Technology, R.A.Gaikwad, PHI publication, 1999
2. Design of Operational Amplifier and Analog Integrated Circuits, S.Franco TMH Publication, 2002

References

1. Linear Integrated Circuits, D.Roy Chaudhari ,New Age International Publisher, 2005

EE702 POWER SYSTEMS DYNAMICS

Teaching Scheme : 04 L + 01 T Total: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

Basics of Power System Dynamics Basic concepts of systems dynamics and stability, types of stability, Basic modeling of power system components for stability studies, dynamics of synchronous machine, swing equation, factors affecting stability and recent trends for improving stability.

Small Disturbance Stability: Steady state stability of two-machine system, power angle curve, stability criterion, definition and computation of SSSL by analytical and graphical methods, effect of inertia, saliency, saturation, governor action and SCR on SSSL.

Large disturbance Stability: Single machine infinite bus (SMIB) system, classical model, equal area criteria technique and its applications to various types of disturbances, numerical method of solving swing equation.

Excitation System: Effect of excitation system on generator power limit, various types of excitation systems, transformation model of excitation system, dynamic stability.

Text Books

1. Power System stability and Control, P.Kundur, McGraw Hill, New York, 2007
2. Modern Power System Analysis , Nagrath and Kothari, McGraw Hill, 2005

References

1. Power System Stability, E.W.Kimbark, Vol 1 and 3 , Dover Publications 1999
2. Power System Dynamics, Stability and Control, K.R.Padiyar Interline Publishers, Ban galore,2007
3. Power System Control and Stability, P.M Anderson and A.A. Fouad, McGraw Hill,2004
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE703 POWER ELECTRONICS - II

Teaching Scheme : 04 L + 00 T Total: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

Introduction to Electrical Drives: Concept, Classification and Advantages. Basic elements, Components of load torque, Torque equation, Equivalent values of drive parameters. Types of mechanical loads. Selection of motor and Controller, Classes of duty, Stability of an electrical drive. Comparison of AC and DC drives.

Starting and Braking of Electrical Drives: Solid-state starters, soft starting, Calculation of starting/acceleration/reversal time and energy loss during starting. Types, advantages, limitations and purposes/objectives of electrical braking, Braking of d c and induction motors.

DC Drives: Single phase half, full and dual converter based d c drives - Circuit configurations, input-output waveforms, Calculation of torque, speed, power factor, firing angle etc. Torque-Speed characteristics. DC Chopper based d c drives - Circuit configurations, input-output waveforms, Calculation of torque, speed, duty cycle etc. Torque-Speed characteristics.

Induction Motor Drives: Scalar control of induction motor – stator voltage and stator frequency control using stator voltage controllers and inverters – circuit configurations, calculation of current, torque, speed etc. Torque-Speed characteristics.

Slip power recovery schemes – rotor chopper / inverter control of induction motor - Circuit configurations and theoretical concepts only.

Industrial Applications: Study of electrical drives in rolling mills, paper mills, cement mills, sugar mills, textile mills, traction and machine tool applications.

Text Books

1. Fundamentals of Electrical Drives, G. K. Dubey, Narosa Publishing House, 2005
2. Electric Drives-Concepts and Applications, V. Subrahmanyam TMH Pub, 2004
3. A first course on Electrical Drives, S.K. Pillay Wiley Eastern Pub, 2002
4. Electric Drives, De and Sen PHI Pub, 1999

References

1. Thyristor DC Drives” P.C. Sen John Wiley & Sons, 1981.
2. Power Electronic Control of AC Motors”, JMD Murphy & FG Turnbull, Pergamon Press, 1988.
3. Power Semiconductor Controlled Drives”, G.K. Dubey PH Int., 1989.
4. Power Semiconductor Drives” Deewan, Straughan & Slemon John Wiley & Sons.
5. <http://www.nptel.iitm.ac.in/>
6. www.ocw.mit.edu

EE704 ELECTRICAL MACHINE DESIGN

Teaching Scheme : 04 L + 00 T Total: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

Introduction: Transformers and three phase induction motors - types, specifications, constructional features, magnetic and insulating materials used;

Computer Aided Design of Machines: Approaches - analysis, synthesis and hybrid methods; Design optimization - variables, constraints and objective function, Problem formulation;

Curves: magnetization, loss and carter's coefficient curves - applications, representation using Piecewise Linearisation and Least Square Error methods.

Transformer Design - Magnetic Circuit Specific electric and magnetic loadings selection, output equation, core and yoke cross sections, main dimensions design, core loss from design data Winding types and design, magnetizing current calculation, primary and secondary winding resistances and leakage reactances from design data; mechanical forces - types, causes and calculations, Thermal circuit cooling methods, Tank wall dimensions design. Design of tank with radiators. Study of Tender drawings & Guaranteed technical Particulars for standard ratings

Induction Motor Stator Design: specific electric and magnetic loadings selection, output equation, main dimensions design, winding - types and design, slot numbers and dimensions design.

Induction Motor Rotor Design: Air gap length design, cage rotor winding design - slot numbers and shapes, bar and ring dimensions; slip ring rotor winding design - slot numbers and shapes, conductors per slot and its cross sections.

Induction Motor Parameters : core loss from design data, magnetomotive force calculation - air gap, stator and rotor cores and teeth; no load current - magnetizing and core loss components, stator and rotor winding resistances and leakage reactances from design data, parameters effect on performance.

Text Books

1. Design of Transformers, Indrajit Dasgupta, Tata McGraw Hill, 1st Edition (Fifth Reprint 2008).
2. Design of Electrical Machines, K.G. Upadhyay, New Age International Publishers, 1st Edition 2008

References

1. The Performance and Design of Alternating Current Machines, M.G. Say, C.B.S. Pub. and Distri., Delhi.
2. Principles of Electrical Machine Design with Computer Programs, S.K. Sen, Oxford and I.B.H. Company Pvt. Ltd., New Delhi.
3. Introductory Methods of Numerical Analysis, S.S. Sastry, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Principles of Electrical Machine Design, R.K. Agrawal, S.K. Kataria and Sons, Delhi.
5. A course in Electrical machine design, A.K. Sawhney, A. Chkrabarti Dhanpat Rai & Co, New Delhi 6th Edition 2006
6. <http://www.nptel.iitm.ac.in/>
7. www.ocw.mit.edu

EE705 ELECTIVE – I

A) POWER SYSTEM OPERATION AND CONTROL

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Economic Operation : Meaning of optimum scheduling, UCP and LSP; Input – Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost; Methods of obtaining incremental fuel costs, Conditions for incremental loading; Optimum scheduling of generation between different units (Only Two plant system without transmission loss).

Transmission loss as a function of plant generation; Calculation of loss co-efficient (Two plant system); Incremental transmission loss; Optimum scheduling of generation between different plants including transmission loss; Concept and significance of penalty factor; Automatic load dispatch: Operation and Functions.

Generator Control Loops: Concept of real and reactive power; Effect of real and reactive power on system parameters; Philosophy of real and reactive power control; Basic generator control loops.

Automatic Voltage Regulator (AVR): Functions of AVR; Types of Exciter; Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Automatic Load Frequency Control: Automatic generation control (AGC); Speed governing system; Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load; Transfer function representation of an isolated generator; Static performance of speed governor; Closing of ALFC loop.

Control Area: Meaning; Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results; Secondary ALFC loop; Integral Control; Pool operation; Tie-line Modeling; Two area system – Dynamic response; Tie-line bias control.

Steady-State Instabilities: Natural torsional oscillatory modes in power system; Natural mode of a single generator operating onto infinite bus; Effect of damper winding; Effect of changing excitation; Power system stabilizer; Introduction to modern control application.

Text Books

1. Power System Analysis, Hadi Saadat , WCB/McGraw-Hill International Edition 1999
2. Electric Energy Systems Theory: An Introduction, O. L. Elgerd , Second edition, McGraw-Hill Book Comp. N. Y. 1987.
3. Modern Power System Analysis, I. J. Nagrath, D. P. Kothari, Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi. 2000

References

1. Economic Operation of Power System, L. K. Kirchamayor Wiley Estem Pvt. Ltd., New Delhi 2007
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EE705 ELECTIVE – I

B) ENERGY MANAGEMENT

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance.

Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

Energy Management & Audit: Definition, need and 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 & energy substitution, energy audit instruments.

Material and Energy Balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Energy Action Planning: Key elements, force field analysis, Energy policy purpose, perspective, contents, formulation, ratification, Organizing - location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability. Motivating-motivation of employees: Information system-designing barriers, strategies; Marketing and communicating-training and planning.

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.

Text Books:

1. Energy –Economy and prospective –Andre Gardel , Pergmann Press-2005
2. Electrical Energy utilization and energy conversion –S.C.Tripathy, Tata Mc-GrawHill -2003
3. Conventional energy technology – S.B.Pandya, Tata Mc-GrawHill -2003

References

1. Energy and Atmosphere, I.M.Campbell, Wiley, New York -2000
2. Power station engineering and economy, Skortzki and Vopat , Tata Mc-GrawHill -2003
3. Introduction to energy technologies , V.A.Venikov ,E.V.Putiatin , Mir, Moskow -2006
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE705 ELECTIVE – I

C) COMPUTER METHODS IN POWER SYSTEM ANALYSIS

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Introduction: Graph of a power system, incidence matrices, primitive network, formation of network matrices by singular and non singular transformation, Representation of power system for computerized analysis, mathematical model of synchronous generator for steady state and transient analysis, transformer with tap changer, transmission line, phase shifter and loads.

Algorithm for formation of bus impedance matrix, modification for changes in the network. Incidence and network matrices for three phase network, transformation matrices, algorithm for formation of bus impedance matrix for three phase networks.

Short Circuit Studies: Symmetrical component, Thevenin's theorem and short circuit analysis of multi node power systems using bus impedance matrix. Short circuit calculations for balanced and unbalanced faults.

Load Flow Analysis: types of buses, load flow equations, power flow solution through GS and NR methods, decoupled and fast decoupled methods, sparsity.

Transient Stability Analysis: Including synchronous machines, system network and loads, solution of swing equation by Euler's, Euler's modified and RK methods.

Economic Load Scheduling: Unit commitment, transmission loss, load scheduling considering transmission losses, unit commitment by dynamic programming method, start up consideration, reliability analysis, hydrothermal scheduling.

Text Books

1. Computer Methods in Power System Analysis, G.W. Stagg & A.H.El-Abiad McGraw Hill 2003
2. Computer Aided Analysis of Sower System , Kusi, PHI-2006

References

1. Modern Power System Analysis (3rd Edn.) , Kothari & Nagrath TMH.-2004
2. Power System Analysis , Hadi Saadat TMH-2004
3. Advanced Power System Analysis and Dynamics, L. P. Singh WEL-2002.
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE705 ELECTIVE – I
D) POWER SYSTEM RELIABILITY

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 05

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Introduction To Power System Reliability: Reliability definition and concept, reliability indices and criteria, availability and reliability

Probability And Reliability : probability concepts, probability distributions, probability distribution in reliability evaluation, reliability indices, network modeling and evaluation of simple networks, system reliability evaluation using probability distributions.

Generation System Reliability Evaluation: Concept of loss of load probability (LOLP), Energy demand(ED), Evaluation of these indices for isolated systems, generation system, reliability analysis using the frequency and duration techniques.

Transmission Systm Reliability Evaluation: Evaluation of LOLP and ED, indices for isolated transmission system, interconnected system reliability

Distribution Systm Reliability Evaluation: Reliability analysis of ring main and radial systems with perfect and imperfect switching.

Text Books

1. Reliability Evaluation of Engineering Systems ,Bilinton R. and Allan Ronald , MIT Press 1985

References

1. Electrical Power System Planning , A.S.Pabla, Machmillan India Ltd. 2000
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EE705 ELECTIVE – I
E) POWER QUALITY AND DEREGULATION

Teaching Scheme	: 04 L + 01 T	Total: 05	Credit: 05
Evaluation Scheme	: 15 CT1 + 15 CT2 +10 TA+ 60 ESE		Total Marks: 100
Duration of ESE	: 2 Hrs.30 min.		

Power Quality: Power quality problems in distribution systems, Harmonics, Harmonics creating loads, Harmonics propagation, series and parallel resonance, harmonic power flow,

Mitigation Of Harmonics: filters, active filters, shunt and series hybrid filters, voltage sag and swells, voltage flicker, Introduction to mitigation of power quality problems using power electronics conditioners

Fundamentals Of Restructured System: History of power system restructuring concept of power system deregulation, regulation vs de-regulation ,entities in deregulated system , Market architecture.

Transmission Open Access Issues: Available transfer capability (ATC), Definition & methods of determination, Transmission network congestion, congestion management techniques

Power Sector Restructuring In India: Electricity act 2003, Evaluation of integrated, monopoly state owned electricity boards, introduction to various institutions in Indian power sector and their role. Ministry of power, SEBS.

Text Books

1. Electrical Power Systems Quality, Dugan Roger ,McGraw-Hill Edition 2002
2. Operation of restructured power system, Bhattacharya Kankar, IEEE Publication.2001

References:

1. FACTS & Power Quality ,Accha Ervin ,IEEE Publication 2001
2. Restructured Electrical Power System, Shahidehpour Mohammad , IEEE Publication 2001
3. Energy generation under new environment, Loi Lei Lai ,John Wiley & Sons Ltd.2001
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE706 POWER ELECTRONICS - II LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed.

(The laboratory may consist of 2-3 simulation studies based on Matlab - Simulink / PSIM / PSPICE platform and one industrial visit for study of electrical drive.)

Representative List:

1. Converter controlled d c motor.
2. Chopper controlled d c motor.
3. Stator voltage controlled induction motor.
4. Stator frequency controlled induction motor.
5. Plugging / rheostatic braking of d c motor.
6. Plugging / rheostatic braking of induction motor.
7. Study of solid state / soft starters for electrical motors.
8. Study of electrical drive in any industry. (Industrial visit)
9. Simulation of 1 / 2 / 4 quadrant Converter controlled dc drive.
10. Simulation of 1 / 2 / 4 quadrant Chopper controlled dc drive
11. Simulation of open loop / closed loop V/f control of I.M.
12. Simulation of rotor chopper control of I.M.

EE707 ELECTRICAL MACHINE DESIGN LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed.

Representative List:

Write a program for following (C/ MATLAB)

1. To fit Loss curve
2. To fit Magnetisation curve
3. TO fit Carter's coefficient curve
4. To determine main dimensions of transformer
5. To design cooling system for transformer
6. To calculate losses from design data
7. To determine No load current of transformer
8. To determine main dimensions of 3 phase Induction motor
9. To design squirrel cage rotor for three phase induction motor
10. To determine No load current of Induction motor
11. To determine winding resistance & leakage resistance from design data

EE708 LINEAR INTEGRATED CIRCUITS LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed.

Representative List:

1. Inverting amplifier using IC 741 and its frequency response.
2. Non-inverting amplifier using IC 741 and its frequency response.
3. Summing amplifier- to build summing amplifier in inverting and non-inverting mode.
4. Measurement of Op-amp parameters: Input offset voltage, input bias current. Input offset current, CMRR.
5. Measurement of slew rate.
6. To build voltage comparator and to generate the waveforms on CRO.
7. Voltage limiter-to build Voltage limiter and to generate the output waveforms.
8. Differentiator -to build and to generate the output waveforms for various values of R and C.
9. Integrator -to build and to generate the output waveforms for various values of R and C.
10. Precision rectifiers-to build precision rectifiers and to generate the output waveforms

EE709 PROJECT AND SEMINAR

Teaching Scheme : 04 P Total: 04
Evaluation Scheme : 100 Internal + 00 External

Credit: 03
Total Marks: 100

100 marks divided in two parts, 50 marks for seminar and 50 marks for project work.

A. Seminar

1. Student shall select a topic for seminar which is not covered in curriculum. Student shall complete the conceptual study of the selected topic and expected to know functional and technical details of selected topic.
2. Before end of semester student shall deliver a seminar and submit the seminar report in proper format.
Introduction
Literature Survey
Concept
Functional and Technical Details
Future scope
Applications
Comparison with similar topics / methods
References
3. Student shall deliver a seminar on submitted report which shall be assessed for 50 marks by two examiners
 - 1) Project Guide
 - 2) Senior faculty appointed by HOD

B. Project

1. In general a group of 4-5 students should be allowed to complete one project.
2. Student should complete the literature survey and finalized the topic for the project
3. They shall submit the synopsis on the selected topic to HOD
4. On approved topic base work should be complete. For hardware project design and procurement of hardware should be complete.
5. At end of semester, group should submit the progress in proper format.
6. Oral examination for 50 marks shall be conducted on the progress report by the examiner panel as follows
 - 1) Project Guide
 - 2) Senior faculty appointed by HOD

EE801 DIGITAL SIGNAL PROCESSING

Teaching Scheme : 04 L + 00 T Total: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Duration of ESE : 2 Hrs.30 min.

Credit: 04

Total Marks: 100

Signals and Signal Processing : Characterization and classification of signals, Typical signal processing operations , Typical signal processing applications , Advantages of digital signal processing

Time Domain Representations Of Signals and Systems: Discrete time signals Operations on sequences, Discrete time systems, Linear time invariant discrete time systems, Characterization of LTI systems.

Transform Domain Representation of Signals And Systems : The discrete time Fourier transform , The frequency response , The transfer function ,Discrete Fourier series ,Discrete Fourier transform , Computation of DFT , Linear convolution using DFT ,The z-transform , The region of convergence of z-transform

Structures For Discrete Time Systems : Block diagram and signal flow representation of constant coefficient , linear difference equation, Basic structures for IIR systems ,Basic structures for FIR systems, Lattice structures , Effects of coefficient quantization , Effect of round off noise in digital filters , Zero-input limit cycles

Filter Design Techniques: Design of discrete time IIR filters from continuous time filters, Design of FIR filters by windowing , Optimum approximation of FIR filters , Linear phase filters

Sampling of Continuous Time Signals : Periodic sampling, Frequency domain representation of sampling, Reconstruction of bandlimited signal from its samples, Discrete time processing of continuous time signals, Continuous time processing of discrete time signals, Changing the sampling rate using discrete time processing

Text Book:

1. Digital Signal processing A computer Based Approach by S.K.Mitra; Third Edition,; McGraw Hill, 2007

Reference Books:

1. Digital Signal Processing by Proakis and Manolakis; Third Edition ; Pearson Education 2006
2. Analog and Digital Signal Processing by Ashok Ambardar Thomson Learning 2007
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EE802 SWITCH GEAR AND PROTECTION

Teaching Scheme : 04 L + 00 T Total: 04

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Circuit Interruption : Circuit breaker control circuit, Fault clearing process, Auto-reclosure, Arc phenomenon- maintenance, properties and interruption theories; AC circuit breakers- current interruption, transient recovery voltage (TRV), rate of rise of TRV, factors affecting TRV, ratings; Inductive and Capacitive current interruptions, current chopping.

Fuses: Types, Constructional features, operation, Characteristics and Applications

Circuit Breaker (Part – I): Air break, Air blast, Bulk oil and minimum oil-types, constructional features, operation and application.

Circuit Breaker (Part – II): SF₆, Vacuum, Miniature, Earth leakage and Moulded Case – types, Constructional features, operation and application; Testing, Installation and Maintenance.

Relaying Principle: Components, Essential features, Characteristics, Terminology, CT's and PT's, Relay classification.

Electromagnetic Relays: Over current, Directional, Distance and Differential – types, constructional features, operation, characteristics and application.

Protection of Transmission Lines

Relaying schemes: overcurrent, earth fault, directional, distance and differential; Parallel feeders and ring mains protection, Carrier current relaying, Overload and Power swing.

Other Power System Elements Protection Transformers, Motors, Generators and Buses.

Modern trends in power system protection

Basic concepts, equipments, comparators, Characteristics realization – over current, directional, differential and distance relay. Microprocessor based relay introduction.

Text Book

1. Power System Protection and Switchgear, Badri Ram and B. N. Vishwakarma, 3rd Edition Tata Mc-Graw Hill Publishing Company Limited, New Delhi. 2003

References

1. Switchgear Handbook, R. T. Lythall, J and P Newness Butterworth, London. 1993.
2. Switchgear and Protection, Sunil S. Rao, 2nd edition, Khanna Publications New Delhi, New
3. Protective Relaying, A. R. Van and C Warrington, Chapman Hall, London., 2 Edition, Vol 1 and 2, 2000
4. Generation Protection and Switchgear, V. A. Slabikov, CIT Press, Coimbatore. 1998.
5. Power System Protection and Switchgear, B. Ravindranath and M Chander, Wiley Eastern Ltd, New Delhi., 2006.
6. Fundamental of power system protection, Y.G. Paithankar and S. R. Bhide, PHI publications, 2008
7. <http://www.nptel.iitm.ac.in/>
8. www.ocw.mit.edu

EE803 ELECTIVE – II

A) HVDC and FACTS

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

DC Power Transmission Technology: Introduction, comparison of AC & DC Transmission, application of DC transmission, Description of DC transmission systems, planning & modern trends.

Analysis of HVDC Converters :3-pulse, 6-pulse,12-pulse converters , converters station and terminal equipment , commutation process, rectifier & inverter operation, equivalent circuit for converters , simplified analysis of Graetz circuit.

Control of Converters And HVDC System Control: Firing angle control, Current and extinction angle control, starting and stopping of DC link, power control, higher level Controllers, Converter faults and protection: Introduction, Converter faults, protection against over current ,over voltage in a converter station, surge arrestors. Smoothing reactor.

Multi Terminal DC Systems: Potential applications of MTDC systems, types of system, operation & control and protection of MTDC systems. Parallel operation of HVDC

Flexible AC Transmission Systems (FACTS): Steady state and dynamics problems in AC systems, Introduction of Flexible AC transmission systems (FACTS) Necessity & objectives of FACTS,

Basic Types of FACTS Controller: Description of static var compensation (SVC), Thyristor controlled series compensation (TCSC), Static condenser (STATCON),Static synchronous series compensator (SSSC) and Unified power flow controller (UPSC)

Text Books

1. HVDC Transmission , Padiyar K.R, Wiley Eastern Ltd ; New Delhi
2. Understanding FACTS: Concepts and Technology of flexible AC transmission system, Hingorani N. G. & Gyugyi L., IEEE press 2000.

References

1. Direct Current Transmission, Kimbark E.W., John Wiley & Sons, 1999
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EE803 ELECTIVE – II

B) HIGH VOLTAGE TRANSMISSION

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Extra High Voltage AC Transmission: Introduction to EHV-AC transmission, transmission line trends & preliminary aspects, standard transmission voltages-power handling capacities and line losses-mechanical aspects.

Electrostatic Field of EHV Lines: Electric shock & threshold currents, capacitance of long object, Effect of Electrostatic field on Human and Animal.

Over Voltages In EHV System: origin & causes, over voltage caused by switching operations, over voltage caused by interruption of low inductive current, over voltage caused by interruption of capacitive currents, Lightning stroke to tower and midspan, Insulation coordination based on lightning

High Voltage DC Transmission: Introduction of DC Power Transmission Technology, Comparison of AC & DC Transmission, Advantages & Application of DC transmission, Types of DC links: Monopolar, Biopolar & homopolar lines

Converters Station and Terminal Equipment: Analysis of HVDC Converters: 3-pulse, 6-pulse, commutation process, rectifier & inverter operation, Ground return, Circuit breaking

Converter Faults and Protection: Introduction, Converter faults, protection against over current, over voltage in a converter station, surge arrestors. Smoothing reactor, Parallel operation of HVDC and HVAC

Text Book

1. Extra High Voltage AC Transmission Engineering , Rakosh Das Begamudre ,New Age International(P) Ltd Third Edition, 2003
2. Electrical Power Systems, C.L.Wadhwa ,New Age International (P) Ltd Fourth Edition 2000

References

1. EHV Transmission Line Reference Book – Edison Electric Institute 1998
 2. Direct Current Transmission , Kimbark E.W , John Wiley & Sons 2003
 3. HVDC Transmission, K.R.Padiyar ,Wiely Eastern Ltd; New Delhi 1995
- C) <http://www.nptel.iitm.ac.in/>
D) www.ocw.mit.edu

EE803 ELECTIVE – II

C) POWER SYSTEM DESIGN PRACTICE

Teaching Scheme	: 04 L + 01 T Total: 05	Credit: 04
Evaluation Scheme	: 15 CT1 + 15 CT2 +10 TA+ 60 ESE	Total Marks: 100
Duration of ESE	: 2 Hrs.30 min.	

Transmission Line Design: Electrical & Mechanical design of transmission line, design of EHV transmission lines.

Design of distribution system: Improvement & expansion of power system

Bus bar arrangement, Isolating switches, current transformer & potential transformer.

Power transformer, Three phase unit Vs bank of single phase unit, Tertiary winding, requirement of tapings, fittings, method of cooling, drying out, rating & their choice, testing, technical details for ordering & tendering.

Lightning arrester, rating, characteristic, testing, standard followed for insulation coordination
Shunt capacitors, need, construction, location, connections, protection, analysis, special types, testing, technical details.

Earthling: earthling systems step potential, touch potential & transfer potential, design of earthling, fencing, and general instructions for laying earthling grid.

Text Books

1. Electrical Power system design, M.V.Deshpande, Tata McGraw Hill, Fourteenth reprint 2000
2. Substation design & equipment , Pratap Sing Satnam & P.V.Gupta Dhanpat Rai &sons, Third edition 1994

References

1. T & D Hand book Westing house.
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EE803 ELECTIVE – II

D) POWER SYSTEM TRANSIENTS

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Introduction: Basic concept and simple switching transient, Transients in electric power systems switching of RL, LC, RLC circuits, Transient analysis for 3 phase Power System-Sequence network, Sequence component for unbalanced network impedance, Analysis of unsymmetrical 3 phase faults

Traveling Waves: Internal and external causes of over voltages, Lightning strokes, Lightning stroke to tower and midspan, Traveling waves in transmission lines, Circuits with distributed constants, Wave equations, Reflection and refraction of traveling waves, Traveling waves at different line terminations, Effect of short length of cables, Shape and attenuation and distortion of traveling waves, Selection of typical wave to represent over voltages, Lattice diagram

Switching Transients : Switching transients, The circuit closing transient, The recovery transient initiated by the removal of the short circuit, Double frequency transients, Abnormal switching transients, Current suppression, Capacitance switching, Arcing, Transformer inrush current, Ferro resonance, Neutral connections, Transients in switching a three phase reactor, Three phase capacitor, The short line fault.

Switching Surges In Transformers, Motors And Generators: Step voltage, Voltage distribution in transformer winding, Winding oscillations, Traveling wave solutions, Transformer core under surge conditions, Voltage surges, Transformers, Generators and motors , Transient parameter values for transformers , Surge diverters, Surge absorbers, Ground fault neutralizers, Protection of lines and stations by shielding, Ground wires, Counter poises, Driven rods, Modern lightning arrestors, Insulation coordination

Generation and Measurement of High Voltages And Current : Generation of high AC and DC voltage, Impulse voltage, Impulse current, Measurement using Sphere gaps peak Voltmeters, Potential dividers ,measurement set-up for transient voltage and current .

Text Books

1. Transients in Power Systems –Lou Van der Sluis, John Wiley & Sons, 1998
2. Transient Phenomenon in Electrical Power System-V.A.Venikov,McMillan Publications, 2000

Reference Books

1. A statistical approach to power system transients- Dr.C.S.Indulkar ,PHI,2003
2. Power System Grounding and transients:An Introduction ,A.P.Sakis Meliopoulos,Marcel Dekker,2002
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE803 ELECTIVE – II
E) HIGH VOLTAGE ENGINEERING

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Mechanism Of Breakdown In Gases: Classification of insulating materials. Gases as insulating media, Ionization & decay process, breakdown in gases, Townsend's law. The streamer mechanism of spark Paschen's law, corona discharge, electronegative gases

Breakdown In Liquid And Solid Dielectrics : Breakdown in pure and commercial liquids, Solid Dielectrics and composite dielectrics, High Voltage bushings, Guarding, Shielding, Field Plotting.

Lightning and Switching over Voltages and Protection: Lightning strokes to lines and towers, mechanism & characteristics. Protection of transmission lines from lightning, Lightning Arrestors. Insulation to co-ordination of HV and EHV transmission line, Power system and substation.

High Voltage and Current Generation: Generation of High D.C, A.C. and Impulse voltages, Standard impulse wave shapes, Switching Surges , High Impulse Generator

High Voltage And Current Measurement: Peak voltage, Impulse voltage and High Direct current Measurement methods, Non-destructive measurement and testing, High Voltage dielectrics Loss and capacitance measurement, Radio Frequency and partial discharge measurement.

High Voltage Testing: Basic Terminology, Testing – Insulation, Bushings, Cables, Transformers, Surge Diverters and Isolators, Electric Shock and threshold current

Text Book

1. High Voltage Engineering, Naidu M.S. and Kamaraju V Tata McGraw Hill Pub. Co. New Delhi Third Edition

References

1. High Voltage Engineering , E. Kuffel and W.S. Zaenglo , Pergamon Press
2. EHV AC Transmission Engineering, Rokosh Das Begamudre, Wiley Eastern Ltd. New Delhi.
3. High Voltage Engineering, D.V.Razevig ,Khanna Pub. New Delhi
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE804 ELECTIVE – III

A) APPLICATIONS OF AI TECHNIQUES TO POWER SYSTEMS

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Technology of Intelligent Systems : Introduction, Fuzzy Logic and Decision Trees, Artificial Neural Networks (ANN), Robust Artificial Neural Network, Expert Systems, Fuzzy Sets and Systems, Expert reasoning and Approximate reasoning

Application of ANN to Short-term Load Forecasting: An ANN approach to the Diagnosis of Transformer Faults, Real-Time Frequency and Harmonic Evaluation using ANN.

Application of Artificial Intelligence to Angle Stability Studies: Introduction, Transient Stability, Critical Clearing Time(CCT), Methods of Fast Assessment of CCT. Knowledge-Based System for Direct Stability Analysis.

Application of Artificial Intelligence to Voltage Stability Assessment and Enhancement to Electrical Power System, ANN-Based Voltage Stability Assessment, ANN-Based Voltage Enhancement, A Knowledge-Based Support System for Voltage Collapse Detection and Prevention (KBVCDP), Implementation of KBVCDP

Evolutionary Computation: Introduction, Genetic Algorithms (GAS), Object –oriented Analysis of GAS, Object oriented GA Design, Evolutionary Programming (EP), Object oriented analysis, Design and implementation of EP.

EP Approach to Reactive Power Planning, Optimal Reactive Power Dispatch using EP, Application of EP to Transmission Network Planning: Introduction, Problem formulation, EP, Numerical Results,

Text Books

1. Intelligent System Applications in Power Engineering , Loi Lei Lai John Wiley Publication-2004
2. Electrical Systems, Dynamics, and Stability with Artificial Intelligence Application , James A. Momoh and Mohamed E. El-Hawary Marcel Dekker, Inc Publication USA -2003

References

1. Genetic Algorithms , David E. Goldberg, Pearson Education -2003
2. Introduction to Neural Systems , Jacek Zurada, Jaico Publishing House -2004
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EE804 ELECTIVE – III

B) NETWORK SYNTHESIS USING OPERATIONAL AMPLIFIERS

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Analog/Digital, Digital/Analog Networks: Multiplexers with MOSFET and JFET switches; Differential input multiplexers, Multitiered multiplexing; Digital to Analog converters- D/A converter designs, sources of error, bipolar operation, multiplying D/A converter; Analog to Digital converters- counter ramp type, continuous ramp type, successive approximation type, dual slope integrator type A/D converter

Sampling Networks: Sample - Hold Modules, sample-hold fundamentals; Sample-hold circuits; Peak detectors, design considerations, non-inverting peak detector circuits, reset and hold mode circuits; Peak to Peak detector; Level detector; Amplitude classifier.

Modulation Networks: Amplitude Modulation- using multipliers, pulse amplitude modulation; Voltage Controlled Oscillator; Voltage to Frequency converters- square wave output VFC, pulse train output VFC, high performance VFC, Pulse width modulation.

Demodulation Networks: Amplitude Demodulation- phase sensitive demodulation, pulse sample demodulator; Demodulation of FM signals- time averaging FM demodulation, FM demodulation by measuring the period, FM demodulation using phase lock techniques; Pulse width demodulation.

Active Filters: Active filter characteristics, pole pairs, network functions, parameters; Filter realizations; Tuning active filter stages; Filter performance; Circuit elements; Filter design and tuning tables.

Text Books

1. Operational amplifier: Design and application, J. G. Graeme, G. E. Tobey McGraw-Hill Publication, 1971
2. Design of Operational Amplifier and Analog Integrated Circuits, S.Franco , TMH Publication, 2002

References

1. <http://www.nptel.iitm.ac.in/>
2. www.ocw.mit.edu

EE804 ELECTIVE – III

C) ARTIFICIAL NEURAL NETWORKS

Teaching Scheme	: 04 L + 01 T	Total: 05	Credit: 04
Evaluation Scheme	: 15 CT1 + 15 CT2 +10 TA+ 60 ESE		Total Marks: 100
Duration of ESE	: 2 Hrs.30 min.		

Introduction: Introduction to Artificial Intelligence, Artificial Neural Network (ANN), Characteristics of ANN

Biological neurons: Function of single biological neuron, Comparison of brain and computer, Comparison between Artificial and Biological neural network.
Basic terminology related to artificial neuron, Basic building blocks of ANN. Network architecture, setting of weights, Activation functions.

Fundamental Models of ANNs and Learning Processes: McCulloch Pitts neuron model, Hebb net.
Concept of Learning with a Teacher, Learning without a Teacher, Different Learning rules such as Hebbian learning rule, Perceptron learning rule, Delta and extended delta learning rule, Competitive learning rule, outstar learning rule, Boltzman learning rule.
Concept of Linear separability

Single Layer Network and Multi-layer Network : Single Layer Perceptron: architecture – training algorithm, Application Procedure, different performance indices, different training stopping conditions and their limitations, learning curves.

Adaline and Medialine Networks: Architecture, Training and Application Algorithms

Back Propagation Network: Architecture, Back propagation Learning algorithm, Selection of parameters, Concept of learning rate, momentum coefficient, Local and global minima, Advantages and disadvantages of BPN.

Radial Basis Function Network: Architecture, Training algorithm

Self Organizing Feature Map: Concept of clustering, Concept of winner unit, methods for determining the winner unit, Kohonen self organizing Feature Map (SOFM).

Applications of ANN: Applications of ANN in bioinformatics, Forecasting (Regression), Pattern recognition (Classification)

Text Books

1. Neural Networks: A Comprehensive Foundation, Simon Haykin ,2nd Edition,Pearson Education 2007

References

1. AI Techniques in Power System, Kelvin Waruicke, Arthur Ekwille, Raj Agarwal, IEE press 2003
2. Introduction to Neural Network, Anderson J.A., MIT press, Cambridge 2006
3. Neural Network , A classroom Approach, Satish Kumar, McGraw Hill , 2008
4. <http://www.nptel.iitm.ac.in/>
5. www.ocw.mit.edu

EE804 ELECTIVE – III
D) DIGITAL IMAGE PROCESSING

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Digital Image Representation: Digitizing images, discrete curves, connected component, space frequency representation, multi resolution representation;

Basics Tools in Image Processing: Point operations (LUT), neighborhood processing (linear filtering, rank filtering, basic morphological filtering);

Image Enhancement Techniques and Image Restoration : Ad'hoc and optimal techniques; Extraction and characterization of visual cues in images : edge detection techniques (first and second derivative operations, matched filtering, optimal edge detectors), texture characterization (co – occurrence matrices, RLC, curvilinear integration, ARMA modeling), Image segmentation; fixed and adaptive histogram threshold, boundary detection and extraction (edge thinning, edge following & edge closing), Region growing techniques, Split & Merge techniques, statistical image segmentation by markovian techniques; Statistical Pattern recognition techniques in images : methods, applications. Image analysis and scene description.

Text Books:

1. Fundamental of Digital Image Processing , Anil K.Jain Prentice Hall-2004

References

1. Digital Image Processing, Gonzalez & Woods 2nd Edition , Prentice Hall -2005
2. Digital Image Processing using MATLAB Gonzalez & Woods , Prentice Hall -2004
3. <http://www.nptel.iitm.ac.in/>
4. www.ocw.mit.edu

EE804 ELECTIVE – III
E) ROBOTICS AND AUTOMATION

Teaching Scheme : 04 L + 01 T Total: 05

Credit: 04

Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE

Total Marks: 100

Duration of ESE : 2 Hrs.30 min.

Introduction: Robot definition, Robot classification, Robotic system components. Notations, Position definitions, Coordinate frames, Different orientation descriptions, Free vectors, Translations, rotations and relative motion, Homogeneous transformations, Spatial Descriptions and Transformations.

Manipulator Kinematics and Mechanics of Robot Motion: Link coordinate frames, Denavit-Hartenberg convention, Joint and end-effectors, Cartesian space, Forward kinematics transformations of position, Inverse kinematics of position, Translational and rotational velocities, Velocity Transformations. Manipulator Jacobian. Forward and inverse kinematics of velocity, Singularities of robot motion, Static Forces, Transformations of velocities and static forces, Joint and End Effectors force/torque transformations.

Manipulator Dynamics: Trajectory Planning, Control. Lagrangian formulation, Model properties, Newton-Euler equations of motion, Joint-based motion planning, Cartesian-based path planning. Independent joint control, Feed-forward control, Inverse dynamics control, Robot controller architectures, Implementation problems.

Automated Manufacturing Systems: Introduction, Manufacturing systems, Performance measure, Computer controlled machines, Material handling systems, Plant layout. Flexible manufacturing system, Computer control system.

Texts Books

1. Introduction to Robotics: Machines and Control, John J. Craig, 3rd Edition, Prentice Hall -2004

References

1. Modeling Identification & control of Robot , W.Khalil & E.Dombare , McGra Hill -2005
2. <http://www.nptel.iitm.ac.in/>
3. www.ocw.mit.edu

EE805 SWITCH GEAR AND PROTECTION LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed.

- 1) To study Characteristics of Miniature circuit breaker
- 2) To study Characteristics of rewirable fuse
- 3) To study parallel feeder
- 4) To study combined protection for generator transformer unit
- 5) To study various circuit breaker
- 6) To study over current relay
- 7) To study earth fault relay
- 8) To study generalized protection scheme

EE806 DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme : 02 P Total: 02

Credit: 01

Evaluation Scheme : 25 Internal + 25 External

Total Marks: 50

It is representative list of practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Minimum eight experiments should be performed.

- 1) Plotting signal with MATLAB
- 2) Step, Impulse response using MATLAB
- 3) Evaluation of convolution and deconvolution
- 4) Evaluation of Laplace, Fourier transforms, DFT etc. with symbolic Math.
- 5) Evaluation of frequency response with MATLAB
- 6) FIR filter design using MATLAB
- 7) IIR filter design using MATLAB
- 8) Implementation of decimation interpolation with MATLAB

EE807 PROJECT AND SEMINAR

Teaching Scheme : 04 P Total: 04

Credit: 09

Evaluation Scheme : 75 Internal + 175 External

Total Marks: 250

1. Project work decided in previous semester will be continued.
2. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
3. Students shall submit the final project report in proper format which shall include the work of both semesters.
4. For uniform and continuous evaluation, evaluation committee for each group shall be formed by HOD in which guide must be a member. Internal marks should be awarded by committee at end of semester based on continuous evaluation.
5. Final examination of project shall include demonstration of working model, presentation of complete work and oral examination based on total project work.

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Equivalence of Courses in New Structure with Old structure

B.Tech : Electrical Engineering

Year : Second Year (Semester - III & IV)

Sr. No	Course in old scheme (212 credits)			Course in new scheme (184 credits)			Remarks
	Course Code	Name of the Course	No of credits	Course Code	Name of the Course	No of credits	
1	EE301	Engineering Mathematics - III	5	SHU303	Engineering Mathematics - III	3	
2	EE304	Electronic Devices and Circuits	4	ETU311	Electronic Devices and Circuits	3	
3	EE601	Signals & Systems	4	EEU301	Signals & Systems	4	
4	EE303	Network Analysis	4	EEU302	Network Analysis	4	
5	EE305	Electrical Measurement and Instrumentation	4	EEU303	Electrical Measurement and Instrumentation	3	
6	EE307	Electronic Devices and Circuits Lab	1	ETU312	Electronic Devices and Circuits Lab	1	
7	No Equivalent			EEU304	Signals & Systems Lab	1	
8	EE306	Network Analysis Lab	1	EEU305	Network Analysis Lab	1	
9	EE308	Electrical Measurement and Instrumentation Lab	1	EEU306	Electrical Measurement and Instrumentation Lab	1	
10	EE609	General Proficiency -II	2	SHU305	General Proficiency - II	2	
11	EE401	Engineering Mathematics- IV	5	SHU401	Engineering Mathematics - IV	3	
12	EE402	Pulse & Digital Circuits	4	EEU401	Pulse & Digital Circuits	4	
13	EE403	Electrical Machines –I	4	EEU402	Electrical Machines - I	3	
14	EE404	Energy Resources & Generation	5	EEU403	Energy Resources & Generation	3	

15	EE302	Electromagnetic Engineering	5	EEU404	Electromagnetic Engineering	4	
16	No Equivalent			SHU402	Engineering Mathematics Lab	2	
17	EE406	Pulse & Digital Circuits Lab	1	EEU405	Pulse & Digital Circuits Lab	1	
18	EE407	Electrical Machines –I Lab	1	EEU406	Electrical Machines - I Lab	1	
19	EE408	Numerical Methods Lab	1	EEU407	Numerical Methods Lab	1	
20	EE309	Computational Lab-I	2	EEU408	Computational Lab - I	1	
21	EE405	Numerical Methods	4	No Equivalent			
22	EE409	Computational Lab-II	2	EEU510	Computational Lab-II	2	