SETHU INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Pulloor, Kariapatti – 626 115.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATIONS 2015

CHOICE BASED CREDIT SYSTEM

CURRICULUM & SYLLABUS

(I SEMESTER to VIII SEMESTER)

APPROVED IN THE ACADEMIC COUNCIL MEETING HELD ON 25.08.2018

CHAIRMAN
BOARD OF STUDIES

Chairperson
Board of Studies
Electrical & Electronics Engineering
Sethu Institute of Technology
Kariapatti - 626 115

CHAIRMAN
ACADEMIC COUNCIL

CHAIRMAN
ACADEMIC COUNCIL
Sethu Institute of Technology
Pulloor, Kariapatti - 625 115

SETHU INSTITUTE OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Department Vision

To achieve Excellence in Education and Research in the field of Electrical and Electronics Engineering and provide knowledge based contribution for the development of economy and society

Department Mission

- Providing comprehensive and value based education in Electrical and Electronics engineering and related fields to meet intellectual, ethical and career challenges
- Providing state-of- the-art infrastructure and resources to promote teaching-learning and research activities
- Enriching the skills to enhance employability and entrepreneurship
- Strengthening the collaboration with academia, industry and research organizations
- Fostering Research and Development activities leading to innovation and technological growth in the overall ambit of electrical and electronics engineering
- Offering services to the society through education, science and technology through education and technology.

Program Educational Objectives (PEOs)

After few years of graduation our Electrical and Electronics Engineering graduates are expected to:	
PEO I (Core Competency)	Exhibit technical competency in Electrical and Electronics Engineering and related fields
PEO II (Life Long Learning)	Engage in life-long learning for professional development and research
PEO III (Professional and Ethical Skills)	Exhibit effective communication skills, team work and lead their profession with ethics

Program Outcomes

PO No.	**PROGRAM OUTCOMES**
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, electrical and electronics engineering fundamentals to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex electrical and electronics engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of solutions:** Design and develop electrical and electronic systems that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
PO4	**Investigation of complex problems:** Investigate and analyze complex electrical and electronics engineering problems using research-based knowledge and

	research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
PO5	**Modern tool usage:** Select and Apply modern engineering and IT tools for simulation and modeling of electrical and electronic systems.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PO9	**Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PO10	**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.
PO11	**Project management and Finance:** Demonstrate knowledge and understanding of 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.
PO12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO No.	**PROGRAM SPECIFIC OUTCOMES**
PSO1	Demonstrate technical competency in the design and analysis of electrical machines.
PSO2	Design and analyze power electronic interfaces for renewable energy systems.

SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti – 626 115

B.E. Degree Program - CBCS CURRICULUM
Regulations 2015

Bachelor of Engineering in Electrical and Electronics Engineering

OVERALL COURSE STRUCTURE

Category	Total No. of Courses	Credits	Percentage
Basic Sciences (BS)	**10**	**28**	**16**
Engineering Sciences (ES)	**13**	**29**	**17**
Humanities and Social Sciences (HS)	**6**	**14**	**8**
Program Core (PC)	**24**	**62**	**35**
Program Electives (PE)	**6**	**18**	**10**
Open Electives (OE)	**3**	**9**	**5**
Project(s) (PRO)	**2**	**15**	**9**
Internships/Seminars	**-**	**-**	**-**
Any other (Please specify)	**1 (Mandatory)**	**-**	**-**
TOTAL	**65**	**175**	**100**

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
EEE	22	21	23	25	24	22	18	20	175

Semester I

Course Cod	Course Title	L	T	P	C
THEORY					
15UEN101	Technical English (Common to ALL Branches)	2	0	0	2
15UMA102	Engineering Mathematics – I (Common to ALL Branches)	3	2	0	4
15UPH103	Engineering Physics (Common to ALL Branches)	3	0	0	3
15UCY105	Applied Chemistry (Common to CSE,ECE,EEE ,IT & Biomedical)	3	0	0	3
15UCS107	Computer Programming	3	0	0	3
15UME108	Engineering Graphics (Common to ALL Branches)	3	2	0	4
PRACTICAL					
15UCS109	Computer Programming Laboratory (Common to ALL Branches)	0	0	2	1
15UME110	Engineering Practices Laboratory (Common to Mech, EEE,Civil,Chemical,Agri & Biomedical)	0	0	2	1
15UGS112	Basic Sciences Laboratory – I (Common to ALL Branches)	0	0	2	1
	TOTAL	**17**	**4**	**6**	**22**
Total No. of Credits – 22					

Semester II

Course Code	Course Title	L	T	P	C
THEORY					
15UEN201	Business English and Presentation Skills (Common to ALL Branches)	3	0	0	3
15UMA202	Engineering Mathematics – II (Common to ALL Branches)	3	2	0	4
15UPH204	Solid State Physics (Common to EEE & Biomedical)	3	0	0	3
15UCY207	Environmental Science (Common to ALL Branches)	3	0	0	3
15UME208	Basic Civil and Mechanical Engineering (Common to MECH & EEE)	3	0	0	3
15UEE209	Electric Circuits	2	2	0	3
PRACTICAL					
15UGS210	Basic Science Laboratory – II (Common to ALL Branches)	0	0	2	1
15UEE211	Electric Circuits Laboratory	0	0	2	1
	TOTAL	**17**	**4**	**4**	**21**
Total No. of Credits – 21					

Semester III

Course Code	Course Title	L	T	P	C
THEORY					
15UMA321	Transforms and Partial Differential Equations **(**Common to MECH, ECE, EEE, Civil, Chemical, Agri, Bio Medical)	3	2	0	4
15UEE302	DC Machines and Transformers	4	0	0	4
15UEE303	Field Theory	3	0	0	3
15UEE304	Power System Generation	3	0	0	3
15UEE305	Semiconductor Devices and Circuits	3	0	0	3
15UEE306	Digital Logic Circuits	4	0	0	4
PRACTICAL					
15UEE307	DC Machines and Transformers Laboratory	0	0	2	1
15UEE308	Semiconductor Devices and Circuits Laboratory	0	0	2	1
	TOTAL	**20**	**2**	**4**	**23**
Total No. of Credits – 23					

Semester IV

Course Code	Course Title	L	T	P	C
THEORY					
15UMA422	Numerical Methods (Common to EEE, CIVIL & CHEMICAL)	3	2	0	4
15UEE402	AC Machines	3	0	0	3
15UEE403	Control Systems	3	2	0	4
15UEE404	Transmission and Distribution	3	2	0	4
15UEE405	Analog Integrated Circuits	3	0	0	3
15UEE406	Electrical Measurements and Instrumentation	3	0	0	3
15UGS431	Reasoning and Quantitative Aptitude (Common to ALL Branches)	1	0	0	1
PRACTICAL					
15UEE408	AC Machines Laboratory	0	0	2	1
15UEE409	Control and Instrumentation Laboratory	0	0	2	1
15UEE410	Digital and Analog Integrated Circuits Laboratory	0	0	2	1
	TOTAL	**19**	**6**	**6**	**25**
Total No. of Credits – 25					

Semester V

Course Code	Course Title	L	T	P	C
THEORY					
15UEE501	Power Electronics	3	0	0	3
15UEE502	Power System Analysis	3	2	0	4
15UEE503	Microprocessors and Microcontroller Programming	3	0	0	3
15UEE504	Electrical Machine Design	3	2	0	4
	Elective I	3	0	0	3
	Elective II	3	0	0	3
PRACTICAL					
15UEE507	Power Electronics Laboratory	0	0	2	1
15UEE508	Microprocessors and Microcontroller Programming Laboratory	0	0	2	1
15UEE509	Electrical Machine Design Simulation Laboratory	0	0	2	1
15UGS531	Soft Skills and Communication Laboratory (Common to CSE, ECE, EEE & IT Branches)	0	0	2	1
	TOTAL	**18**	**4**	**8**	**24**
Total No. of Credits – 24					

Semester VI

Course Code	Course Title	L	T	P	C
THEORY					
15UEE601	Advanced Electric Drives and Control	2	0	2	3
15UEE602	Protection and Switch Gear	3	0	0	3
15UEC621	Signal Processing (Common to EEE & EIE)	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
	Open Elective – I	3	0	0	3
PRACTICAL					
15UCS627	Problem Solving using “C” (For EEE)	0	0	2	1
15UEE608	Technical Project	0	0	6	3
	TOTAL	**17**	**0**	**10**	**22**
Total No. of Credits – 22					

Semester VII

Course Code	Course Title	L	T	P	C
THEORY					
15UME701	Project Management & Finance (Common to MECH,CSE,ECE,EEE,IT & EIE)	3	0	0	3
15UEE702	Power System Operation and Control	3	2	0	4
15UEE703	Electric Energy Utilization	3	0	0	3
	Elective V	3	0	0	3
	Open Elective – II	3	0	0	3
PRACTICAL					
15UEE706	Power System Simulation Laboratory	0	0	2	1
15UEC727	Signal Processing Laboratory	0	0	2	1
	TOTAL	**15**	**2**	**4**	**18**
Total No. of Credits –18					

Semester VIII

Course Code	Course Title	L	T	P	C
THEORY					
15UME801	Professional Ethics (Common to ALL Branches)	2	0	0	2
	Elective VI	3	0	0	3
	Open Elective – III	3	0	0	3
PRACTICAL					
15UEE804	Project Work	0	0	24	12
	TOTAL	**8**	**0**	**24**	**20**
Total No. of Credits – 20					

LIST OF PROGRAM ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
1.	15UEE901	Network Analysis and Synthesis	3	0	0	3
2.	15UEE902	Advanced Control Theory	3	0	0	3
3.	15UEE903	High Voltage Engineering	3	0	0	3
4.	15UEE904	HVDC Transmission	3	0	0	3
5.	15UEE905	Software circuit for Simulation	3	0	0	3
6.	15UEE906	Special Electrical Machines	3	0	0	3
7.	15UEE907	Computer Aided Design of Electrical Apparatus	2	0	2	3
8.	15UEE908	Introduction to Micro Electro Mechanical Systems	3	0	0	3
9.	15UEE909	Micro Grid and Distributed Generation Systems	3	0	0	3
10.	15UEE910	VLSI Design and Architecture	3	0	0	3
11.	15UEE911	Adaptive Control	3	0	0	3
12.	15UEE912	Operation and Maintenance of Electrical Equipments	3	0	0	3
13.	15UEE913	Power System Transients	3	0	0	3
14.	15UEE914	Numeric Relays	3	0	0	3
15.	15UEE915	Neural Network and Fuzzy Systems	3	0	0	3
16.	15UEE916	Embedded Systems	3	0	0	3
17.	15UEE917	Power Electronics for Renewable Energy Systems	3	0	0	3
18.	15UEE918	Power Quality	3	0	0	3
19.	15UEE919	Flexible AC Transmission System	3	0	0	3
20.	15UEE920	Evolutionary Computation	3	0	0	3
21.	15UEE921	Power System Dynamics	3	0	0	3
22.	15UEE922	Deregulation and Restructured Power systems	3	0	0	3
23.	15UEE923	Smart Grid Technologies	3	0	0	3
24.	15UEE924	Energy Audit	3	0	0	3
25.	15UEE925	Erection, Testing and Commissioning of Electrical Equipments	3	0	0	3
26.	15UEE926	PLC and SCADA Applications	3	0	0	3
27.	15UEE927	Power Plant Instrumentation and control	3	0	0	3

Sl. No.	Course Code	Course Title	L	T	P	C
28.	15UEC954	Principles of Communication Engineering	3	0	0	3
29.	15UCS955	Data structure and Algorithm Analysis in C	3	0	0	3
30.	15UPH951	Fundamentals of Nano Science	3	0	0	3

LIST OF OPEN ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C
1	15UEE971	Non Conventional Energy Resources and Applications	3	0	0	3
2	15UEE972	Electric and Hybrid Vehicles	3	0	0	3
3	15UEE973	Solar Power Plants	3	0	0	3
4	15UEE974	MEMS	3	0	0	3
5	15UEE975	Principles of Robotics	3	0	0	3
6	15UEE976	Applied Soft Computing	3	0	0	3

LIST OF MANDATORY COURSES

CATEGORY	COURSES
Personality and Social Development	Sports
	National Service Scheme
	Club Activities (ECO Club, Red Ribbon Club, YRC, Photography Club)
	Extra Curricular Activities
Skills Development	English Proficiency Certificate such as BEC, TOFEL, IELTS
	Foreign Languages
	Soft Skills and Aptitude
	Aptitude Proficiency certificate such as GRE, GMAT, CAT
	Co-Curricular Activities
	Intellectual Property Rights
Value Education	Value Education and Human Rights

LIST OF INDUSTRY DESIGNED COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
1	15UEE861	Wind farm Development and Operation	1	0	0	1
2	15UEE862	Design of Towers and Blades Structures	1	0	0	1
3	15UEE863	Wind Turbine Blades Fabrication Technology	1	0	0	1
4	15UEE864	Solar Photovoltaic Technology	1	0	0	1
5	15UEE865	Industrial safety measures	1	0	0	1
6	15UEE866	ECO Paint Application Technology for Automobile Industry	1	0	0	1
7	15UEE867	Energy Storage Systems	1	0	0	1
8	15UEE868	Controlling and Monitoring of Electrical Equipments using Mobile Applications	1	0	0	1
9	15UEE869	Electrical Rewinding Laboratory	1	0	0	1

LIST OF INTERDISCIPLINARY COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
1	15UGM954	Smart Buildings	3	0	0	3
2	15UGM955	Electric Vehicles	3	0	0	3
3	15UGM956	Electrical Hazards & Safety In Hospitals	3	0	0	3

LIST OF COURSES BASED ON THE COMPONENTS OF CURRICULUM

S.No.	Name of the Courses	Credits	No. of contact hours
HUMANITIES & SOCIAL SCIENCES			
1.	Technical English	2	30
2.	Business English and Presentation Skills	3	45
3.	Environmental Science	3	45
4.	Soft Skills and Communication Laboratory	1	30
5.	Project Management & Finance	3	45
6.	Professional Ethics	2	30
	TOTAL	**14**	**225**
BASIC SCIENCES			
1.	Engineering Mathematics I	4	75
2.	Engineering Physics	3	45
3.	Applied Chemistry	3	45
4.	Basic Sciences Laboratory - I	1	30
5.	Engineering Mathematics – II	4	75
6.	Solid State Physics	3	45
7.	Basic Sciences Laboratory - II	1	30
8.	Transforms and Partial Differential Equations	4	75
9.	Numerical Methods	4	75
10.	Reasoning and Quantitative Aptitude	1	15
	TOTAL	**28**	**510**
ENGINEERING SCIENCES			
1.	Computer Programming	3	45
2.	Engineering Graphics	4	75
3.	Computer Programming Laboratory	1	30
4.	Engineering Practices Laboratory	1	30
5.	Basic Civil and Mechanical Engineering	3	45
6.	Electric Circuits	3	60
7.	Electric Circuits Laboratory	1	30
8.	Problem solving using “C”	1	30
9.	Digital Logic Circuits	4	60
10.	Semiconductor Devices and Circuits	3	45
11.	Semiconductor Devices and Circuits Laboratory	1	30
12.	Analog Integrated Circuits	3	45
13.	Digital and Analog Integrated Circuits Laboratory	1	30
	TOTAL	**29**	**555**
PROGRAM CORE			
1.	DC Machines and Transformers	4	60
2.	Field Theory	3	45
3.	Power System Generation	3	45
4.	DC Machines and Transformers Laboratory	1	30

S.No.	Name of the Courses	Credits	No. of contact hours
5.	AC Machines	3	45
6.	Transmission and Distribution	4	75
7.	Electrical Measurements and Instrumentation	3	45
8.	AC Machines Laboratory	1	30
9.	Power Electronics	3	45
10.	Control Systems	4	75
11.	Power System Analysis	4	75
12.	Microprocessors and Microcontroller Programming	3	45
13.	Protection and Switch Gear	3	45
14.	Power Electronics Laboratory	1	30
15.	Control and Instrumentation Laboratory	1	30
16.	Microprocessors and Microcontroller Programming Laboratory	1	30
17.	Electrical Machine Design Simulation Laboratory	1	30
18.	Advanced Electric Drives and Control	3	60
19.	Electrical Machine Design	4	75
20.	Signal Processing	3	45
21.	Signal Processing Laboratory	1	30
22.	Power System Operation and Control	4	75
23.	Electric Energy Utilization	3	45
24.	Power System Simulation Laboratory	1	30
	TOTAL	**62**	**1140**
PROGRAM ELECTIVES			
1.	ElectiveI	3	3
2.	Elective II	3	3
3.	ElectiveIII	3	3
4.	ElectiveIV	3	3
5.	ElectiveV	3	3
6.	Elective VI	3	3
	TOTAL	**18**	**270**
OPEN ELECTIVES			
1.	Open Elective I	3	3
2.	Open Elective II	3	3
3.	Open Elective III	3	3
	TOTAL	**09**	**135**
PROJECT			
1.	Technical Project	3	90
2.	Project Work	12	360
	TOTAL	**15**	**450**

COURSE CATEGORIZATION

Employability Enhanced Courses

S.No.	Course Code	Course Title	L	T	P	C
1	15UEN101	Technical English	2	0	0	2
2	15UMA102	Engineering Mathematics – I	3	2	0	4
3	15UPH103	Engineering Physics	3	0	0	3
4	15UCY105	Applied Chemistry	3	0	0	3
5	15UCS107	Computer Programming	3	0	0	3
6	15UME108	Engineering Graphics	3	2	0	4
7	15UCS109	Computer Programming Laboratory	0	0	2	1
8	15UME110	Engineering Practices Laboratory	0	0	2	1
9	15UGS112	Basic Sciences Laboratory – I	0	0	2	1
10	15UEN201	Business English and Presentation Skills	3	0	0	3
11	15UMA202	Engineering Mathematics – II	3	2	0	4
12	15UPH204	Solid State Physics	3	0	0	3
13	15UCY207	Environmental Science	3	0	0	3
14	15UME208	Basic Civil and Mechanical Engineering	3	0	0	3
15	15UEE209	Electric Circuits	2	2	0	3
16	15UGS210	Basic Science Laboratory – II	0	0	2	1
17	15UEE211	Electric Circuits Laboratory	0	0	2	1
18	15UMA321	Transforms and Partial Differential Equations	3	2	0	4
19	15UEE302	DC Machines and Transformers	4	0	0	4
20	15UEE303	Field Theory	3	0	0	3
21	15UEE304	Power System Generation	3	0	0	3
22	15UEE305	Semiconductor Devices and Circuits	3	0	0	3
23	15UEE306	Digital Logic Circuits	4	0	0	4
24	15UEE307	DC Machines and Transformers Laboratory	0	0	2	1
25	15UEE308	Semiconductor Devices and Circuits Laboratory	0	0	2	1
26	15UEE402	AC Machines	3	0	0	3
27	15UEE403	Control Systems	3	2	0	4
28	15UEE404	Transmission and Distribution	3	2	0	4
29	15UEE405	Analog Integrated Circuits	3	0	0	3

S.No.	Course Code	Course Title	L	T	P	C
30	15UEE406	Electrical Measurements and Instrumentation	3	0	0	3
31	15UGS431	Reasoning and Quantitative Aptitude	1	0	0	1
32	15UEE408	AC Machines Laboratory	0	0	2	1
33	15UEE409	Control and Instrumentation Laboratory	0	0	2	1
34	15UEE410	Digital and Analog Integrated Circuits Laboratory	0	0	2	1
35	15UEE501	Power Electronics	3	0	0	3
36	15UEE502	Power System Analysis	3	2	0	4
37	15UEE503	Microprocessors and Microcontroller Programming	3	0	0	3
38	15UEE504	Electrical Machine Design	3	2	0	4
39	15UEE507	Power Electronics Laboratory	0	0	2	1
40	15UEE508	Microprocessors and Microcontroller Programming Laboratory	0	0	2	1
41	15UEE509	Electrical Machine Design Simulation Laboratory	0	0	2	1
42	15UGS531	Soft Skills and Communication Laboratory	0	0	2	1
43	15UEE601	Advanced Electric Drives and Control	2	0	2	3
44	15UEE602	Protection and Switch Gear	3	0	0	3
45	15UEC621	Signal Processing	3	0	0	3
46	15UCS627	Problem Solving using “C”	0	0	2	1
47	15UEE608	Technical Project	0	0	6	3
48	15UEE702	Power System Operation and Control	3	2	0	4
49	15UEE703	Electric Energy Utilization	3	0	0	3
50	15UEE706	Power System Simulation Laboratory	0	0	2	1
51	15UEC727	Signal Processing Laboratory	0	0	2	1
52	15UME801	Professional Ethics	2	0	0	2
53	15UEE804	Project Work	0	0	24	12
54	15UEE903	High Voltage Engineering	3	0	0	3
55	15UEE906	Special Electrical Machines	3	0	0	3
56	15UEE915	Neural Network and FUZZY Systems	3	0	0	3
57	15UEE918	Power Quality	3	0	0	3
58	15UEE924	Energy Audit	3	0	0	3

S.No.	Course Code	Course Title	L	T	P	C
59	15UEE925	Erection, Testing and Commissioning of Electrical Equipments	3	0	0	3
60	15UEE926	PLC and SCADA Applications	3	0	0	3

Entrepreneurship Development Courses

S.No.	Course Code	Course Title	L	T	P	C
1	15UEE608	Technical Project	0	0	6	3
2	15UME801	Professional Ethics	2	0	0	2
3	15UEE804	Project Work	0	0	24	12
4	15UEE918	Power Quality	3	0	0	3

Skill Development Courses

S.No.	Course Code	Course Title	L	T	P	C
1	15UEE608	Technical Project	0	0	6	3
2	15UEE804	Project Work	0	0	24	12
3	15UEN101	Technical English	2	0	0	2
4	15UCS107	Computer Programming	3	0	0	3
5	15UME108	Engineering Graphics	3	2	0	4
6	15UCS109	Computer Programming Laboratory	0	0	2	1
7	15UME110	Engineering Practices Laboratory	0	0	2	1
8	15UEN201	Business English and Presentation Skills	3	0	0	3
9	15UEE305	Semiconductor Devices and Circuits	3	0	0	3
10	15UEE405	Analog Integrated Circuits	3	0	0	3
11	15UGS431	Reasoning and Quantitative Aptitude	1	0	0	1
12	15UEE409	Control and Instrumentation Laboratory	0	0	2	1
13	15UEE507	Power Electronics Laboratory	0	0	2	1
14	15UEE508	Microprocessors and Microcontroller Programming Laboratory	0	0	2	1

S.No.	Course Code	Course Title	L	T	P	C
15	15UEE509	Electrical Machine Design Simulation Laboratory	0	0	2	1
16	15UGS531	Soft Skills and Communication Laboratory	0	0	2	1
17	15UEE706	Power System Simulation Laboratory	0	0	2	1
18	15UEE915	Neural Network and FUZZY Systems	3	0	0	3
19	15UEE926	PLC and SCADA Applications	3	0	0	3

TECHNICAL ENGLISH

15UEN101 **(Common to ALL Branches)**

L	T	P	C
2	0	0	2

OBJECTIVES:

- To enhance the vocabulary of students
- To strengthen the application of functional grammar and basic skills
- To improve the language proficiency of students

UNIT I **6**

Grammar - Parts of Speech-Tense – **Vocabulary** – Technical Word Formation- Prefix- suffix - Synonyms and Antonyms– **Writing** – Instructions – Formal Letters - **Reading** Comprehension - Prose: A Nation's Strength – Dr. Karan Singh

UNIT II **6**

Grammar – Concord -'Wh' Questions – Vocabulary – One Word Substitutes – Listening & Speaking – Conducting Meetings – Writing - Preparation of the Checklist, Essaywriting – Reading -Prose: My Vision of India - Dr.A.P.J.AbdulKalam.

UNIT III **6**

Grammar – Voice – **Vocabulary** – Compound Nouns **Writing** – Minutes – Agenda - Transformation of Information (Transcoding)- **Reading Prose:** Professions of Women-Virginia Woolf.

UNIT IV **6**

Grammar - Conditional clauses - **Vocabulary** - Idioms & Phrases - **Writing** Letters to Editor - Making Invitations - Acceptance & Declining - Summarizing – **Reading** - Prose: Computers-Peter Laurie

UNIT V **6**

Grammar – Determiners – **Vocabulary** – Homophones & Homonyms – **Writing** Recommendations- Note Making - Report Writing- **Reading** – Prose: What We Must Learn From the West-Narayana Murthy

TOTAL: 30(L) = 30 PERIODS

COURSE OUTCOMES

After successful completion of this course the students will be able to:

- Use grammar effectively in writing meaningful sentences and paragraphs. [Apply]
- Exhibit improved reading comprehension and vocabulary. [Understand]
- Demonstrate writing skills in various formal situations. [Create]
- Demonstrate improved oral fluency. [Create]
- Presenting reports on various purposes. [Create]

TEXT BOOK:

S.M.Rajasangar*Technical English*, Rathna Arts,Sivakasi, 2018.

REFERENCE BOOKS:

1. Asraf Rizvi.M, Effective Technical Communication, New Delhi, Tata McGrawHillPublishingCompany Limited, 2007.
2. Lakshminarayanan. K.R,English for Technical Communication, Chennai, Scitech Publications (India) Pvt. Ltd, 2004.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1										3		3		
CO.2										3		3		
CO.3										3		3		
CO.4									2	3		3		
CO.5										3		3		

15UMA102	ENGINEERING MATHEMATICS – I (Common to ALL Branches)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To make the students capable of identifying algebraic eigen value problems from practical areas and obtain the eigen solutions in certain cases.
- To make the students knowledgeable in integrating various types of functions using various integration methods.
- To familiarize the students with the basic rules of differentiation and use them to find derivatives of products and quotients that they might encounter in their studies of other subjects in the same or higher semesters.

UNIT I DIFFERENTIAL CALCULUS 9 + 6

Introduction – Definition of derivatives – Limits and Continuity – Differentiation techniques (Product rule, Quotient rule, Chain rule) – Successive differentiation (n^{th} derivatives) – Leibnitz theorem (without proof) – Maclaurin's series – Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay of radioactive materials - Chemical reactions and solutions, Ohm's law, Kirchoff's law – Simple electric circuit problems)

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9 + 6

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobian – Taylor's expansion – Maxima and Minima – Method of Lagrangian Multipliers.

UNIT III INTEGRAL CALCULUS 8 + 6

Definitions and concepts of integrals – Methods of integration (Decomposition method, Substitution method, Integration by parts) – Definite integrals – Properties and problems – Reduction formulae – Beta and Gamma functions.

UNIT IV MULTIPLE INTEGRALS 8 + 6

Double integration – Cartesian and Polar coordinates – Change of order of integration – Area as a double integral - Change of variables between Cartesian and Polar coordinates – Triple integration

in Cartesian coordinates – Volume as triple integral.

UNIT V MATRICES 8 + 6

Eigenvalue and eigenvector of a real matrix – Characteristic equation – Properties – Cayley-Hamilton theorem (excluding Proof) – Orthogonal reduction –(transformation of a symmetric matrix to diagonal form)– Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

SUPPLEMENT TOPIC (for internal evaluation only) 3

Evocation /Application of Mathematics, Quick Mathematics – Speed Multiplication and Division Applications of Matrices.

TOTAL : 45 (L) + 30 (T) = 75 PERIODS

COURSE OUTCOMES:

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

- Analyze functions using limits, continuity and derivatives to solve problems involving these functions. [Analyze]
- Use the Lagrange multiplier method to predict extreme values of functions with constraints and to find the absolute maximum and minimum of a function on different domains. [Apply]
- Apply the various methods of integration for evaluating definite integrals. [Apply]
- Apply the knowledge of multiple integrals to findthe area and volume of region bounded by the given curves. [Apply]
- Find Eigen values and Eigenvectors for symmetric and non-symmetric matrices. [Apply]

TEXT BOOKS:

1. BALI N. P and MANISH GOYAL, “A Text book of Engineering Mathematics”, Laxmi Publications (P) Ltd, New Delhi, 8th Edition, (2011).
2. GREWAL. B.S, “Higher Engineering Mathematics”, Khanna Publications, New Delhi, 42ndEdition, (2012).

REFERENCE BOOKS:

1. RAMANA B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. GLYN JAMES, "Advanced Engineering Mathematics",Pearson Education, New Delhi, 7th Edition, (2007).
3. JAIN R.K and IYENGAR S.R.K," Advanced Engineering Mathematics", Narosa Publishing House, New Delhi, 3rd Edition, (2007).
4. BHARATI KRISHNA TIRTHAJI, "Vedic Mathematics - Mental Calculation",MotilalBanarsidass Publications, New Delhi, 1st Edition, (1965).
5. KREYSZIG. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, (2011).
6. P.SIVARAMAKRISHNA DAS,E.RUKMANGADACHARI"Engineering mathematics",volume1, Pearson Edison New Delhi, 2nd Edition, (2013).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3		1								1	2	
CO.2	3			1								1	2	
CO.3	3			1								1	2	
CO.4	3			1								1	2	
CO.5	3			1								1	2	

15UPH103	ENGINEERING PHYSICS (Common to ALL Branches)	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To develop knowledge on principles of Thermal Physics
- To make students to understand classification of sound and applications of Ultrasonics
- To use the principles of Lasers and its types
- To apply principles of Quantum physics in engineering field
- To develop the research interest in crystal physics

UNIT I CRYSTAL PHYSICS 9

Crystalline – Amorphous materials – single and poly crystal- Lattice – Unit cell – Bravais lattice Lattice planes – Miller indices – parameters of Unit cell – Coordination number – Packing factor f SC, BCC, FCC and HCP structures – crystal growth technique- Bridgman method.

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound – decibel- weber- Fechner law – Units of Loudness- decibel- phon- sone Reverberation – Absorption Coefficient –Introduction to ultrasonics- magnetostriction effect - piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves - properties - Cavitations -Velocity measurement – acoustic grating - Industrial applications – SONAR .

UNIT III WAVE OPTICS AND LASERS 9

Introduction – interference – refractive index –Expression for plane, circularly and ellipticall polarized light LASER: Introduction- Principles of Laser- Einstein theory of stimulated emission Population inversion Methods - Types of lasers – Co_2 laser - semiconductor laser – homojunctio –heterojunction - Applications.

UNIT IV QUANTUM PHYSICS 9

Introduction to black body - de Broglie wavelength – Schrödinger's wave equation – Tim dependent – Time independent equation – Physical significance of wave function - Compto Effect – Theory and experimental verification .

UNIT V PROPERTIES OF SOLIDS AND THERMAL PHYSICS 9

Elasticity- Hooke's law - Relationship between three modulii of elasticity – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending - Thermal conductivity- Newton's law of cooling – Lee's disc method - Thermal insulation in buildings- Concept of Entropy.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply the concepts of crystal structures and discuss the significance of fundamentals and defects. [Apply]
- Apply the knowledge of Acoustics and Ultrasonics to find velocity and acoustics parameters for industrial applications. [Apply]
- Explain the classification of different types of laser and its applications. [Understand]
- Explain different types of wave equations and functions. [Understand]
- Apply the concepts of Elasticity and thermal conductivity to solve the problems related to structural and thermal applications. [Apply]

TEXT BOOKS:

1. Dr. Mani.P, "A Text Book of Engineering Physics", Dhanam Publications, Edition ,2014, Chennai.
2. Rajendran.V, "Engineering,Physics", Tata Mc-Graw Hill Publishing Company limited, New Delhi, Revised Edition 2013.
3. Palanisami P.K., "Physics For Engineers", Scitech Publications (India), Pvt Ltd., Chennai, 2014.

REFERENCE BOOKS:

1. Raghuvenshi G.S., "Engineering Physics", PHI Learning Private Limited, New Delhi, Revised Edition 2014.
2. Arul doss .G., "Engineering Physics", PHI Learning Limited, New Delhi, Revised Edition 2013.
3. Marikani .A., "Engineering Physics", PHI Learning Private Limited, New Delhi, Revised Edition 2012.
4. Sankar B.N., and Pillai .S.O., "A Text book of Engineering Physics", New Age International Publishers Private Limited, New Delhi, Revised Edition 2013.

5. Avadhanulu M.N. and Kshirsagar P.G., “A Textbook: of Engineering Physics”, S.Chand& Company Ltd., New Delhi, 2015.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3												2	2
CO.2	3												2	2
CO.3	2												2	2
CO.4	2												2	2
CO.5	3												2	2

15UCY105	APPLIED CHEMISTRY (Common to ECE, EEE, CSE , IT,& Biomedical Engineering)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduction to the fundamental concepts of chemical bonds.
- Understand the principles and applications of corrosion science.
- Gain knowledge about energy storage devices & Electrochemical sensors.
- Understand the principlesand applications of spectroscopy and the concept of green chemistry.
- Acquire knowledge on smart materials.

MODULE-I CHEMICAL BONDING 9

Chemical Bonding: Electronic Configuration– Ionic Bond - Covalent Bond – Metallic bond – Aufbau principle, Octet Rule, Pauli Exclusion principle, Molecular Orbital theory, Valence bond theory and its limitations, Various types of hybridization (SP, SP^2 , SP^3)(Homo nuclear& H_2, N_2, O_2) and shapes of molecules based on MO theory -bond strength and bond energy, Born-Haber cycle, Fajan's rule–Non Covalent Bonding-Hydrogen bonding, Vander Waals forces.

MODULE–II ELECTRO CHEMISTRY AND CORROSION 9

Electrochemistry: Introduction -Electrochemical cells- reversible and irreversible cells – EMF – measurement of EMF-Single electrode potential-Nernst equation.

Chemical corrosion: Introduction- Definition- Types - (Dry corrosion, mechanism and its Example)-Electrochemical corrosion (Wet corrosion, mechanism and its Types – Galvanic & Differential aeration Corrosion- Pitting, crevice & Wire fence corrosion). Factors influencing rate of corrosion. Corrosion prevention - Cathodic protection, Corrosion inhibitors, and Protective coatings – Paint, Electroplating – Gold plating-Risk Analysis -Electroless plating – Nickel plating

MODULE- III CONVENTIONAL ENERGY STORAGE DEVICES AND SENSORS 9

Conventional devices - Batteries- Primary and secondary batteries- Construction, working and applications of Zn – MnO_2, Lead acid storage and Cd batteries. Fuel cells – Differences between battery and fuel cell, construction and working of H_2 – O_2 fuel cell.

Electrochemical sensors: Chemically modified electrode (CMEs) – Concept, CMEs sensors, Chemical sensors – gas sensors – ion selective electrodes, principle, types (solid state membranes and liquid membranes) and applications. Biosensors – electrochemical biosensors – glucose biosensors.

MODULE- IV INSTRUMENTATION FOR ANALYTICAL METHODS AND GREEN CHEMISTRY 9

Beer-Lamberts law - Principle, instrumentation and applications –UV-Visible spectrophotometer-X-ray diffractometer - Thermo Gravimetric Analysis (TGA) - Differential Thermal Analysis (DTA)-Differential Scanning Colorimetry (DSC).

Green chemistry – Concept, importance, principles – e- waste disposal

MODULE- V POLYMERS& SMART MATERIALS 9

Introduction- Terminology- structure and properties -Types of Polymerisation-Conducting polymers – Chemical and Electrochemical doping; Charge transfer polymer – Polymers filled with conductive solids, Organic Light emitting diodes – Principles and applications, Liquid crystals – definition and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Describe the theories of chemical bonding and molecular structure. [Understand]
- Analyze the use of electrochemistry and corrosion prevention techniques. [Analyze]
- Describe the importance of energy storage devices and electrochemical sensors. [Understand]
- Explain the principles of instrumentations for Analytical methods and green chemistry. [Understand]
- Describe the applications of different polymers and liquid crystals. [Understand]

TEXT BOOKS:

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2002.
2. Dr.Sunita Rattan, “A Textbook of Engineering Chemistry” S.K.Kataria& Sons., New Delhi,2013.

REFERENCES:

1. Derek Pletcher and Frank C. Walsh, “Industrial Electrochemistry”, Chapman and Hall, New York, 1993.
2. Peter Grundler, “ Chemical Sensors – An introduction for Scientists and Engineers”, Springer, New York, 2007.
3. ArnostReiser, “Photoreactive Polymers the Science and Technology of Resists”, Wiley Interscience, New York,1989.
4. Paul T. Anastas, John C. Warner, ‘Green Chemistry: Theory and Practice’, Oxford University Press, (2000).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2													
CO.2	3	3												
CO.3	2													
CO.4	2													
CO.5	2													

15UCS107	COMPUTER PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart the concepts in basic organization of computers and problem solving techniques.
- To familiarize the programming constructs of C.
- To explain the concepts of arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION **8**

Generation and Classification of Computers - Basic Organization of a Computer – Problem formulation – Problem Solving - Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS **9**

Introduction to ' C' programming – fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations

UNIT III DECISION MAKING AND LOOPING STATEMENTS **10**

if - if-else - nested if-else – else-if ladder statement – switch – goto – for- while – do-while – break – continue statements – Problem solving with decision making and looping statements

UNIT IV ARRAYS, STRINGS AND FUNCTIONS **9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays - Function – definition of function – Declaration of function – Parameter passing methods – Recursion - Storage classes – Problem solving with arrays, strings and functions

UNIT V POINTERS, STRUCTURES AND UNIONS **9**

Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic Memory allocation – Structure - need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Pre-processor directives.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply the knowledge of problem solving techniques to the solutions of computing problems. [Apply]
- Make use of sequential constructs to provide solutions for computing problems. [Apply]
- Select suitable control constructs to provide computing solutions. [Apply]
- Apply the knowledge of modularity to the solutions of computing problems. [Apply]
- Develop solutions to computing problems handling homogeneous and heterogeneous data. [Apply]

TEXT BOOKS:

1. Balagurusamy. E. “Programming in Ansi C”, Third Edition, Tata Mr Graw-Hill Publishing Company Limited, New Delhi, 2005.
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, Oxford University Press, First Edition, 2009.
3. Behrouz A. Forouzan, Richard F.Gilberg, “A Structured Programming Approach using C”, Third Edition, Thomson Course Technology, 2007.

REFERENCE BOOKS:

1. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, 2011.
2. Kernighan.B.W ,Ritchie.D.M, “The C Programming language”, Pearson Education, Second Edition, 2006.
3. Stephen G.Kochan, “Programming in C”, Pearson Education India, Third Edition, 2005.
4. Anita Goel ,Ajay Mittal, ” Computer Fundamentals and Programming in C””, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011.
5. Byron S Gottfried,” Programming with C ”, Schaum’s Outlines, Tata McGraw-Hill, Second Edition, 2006.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2	2											
CO.2	3	2	2											
CO.3	3	2	2											
CO.4	3	2	2											
CO.5	3	2	2											

15UME108	ENGINEERING GRAPHICS (Common to ALL Branches)	L 3	T 2	P 0	C 4

OBJECTIVES:

- To develop in students graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings
- To impart knowledge in development of surfaces, isometric and perspective projections

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) **1**

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning

UNIT I **PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANE SURFACES** **9+5**

Plane Curves: (Not for Examination)

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

Projections:

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT II **PROJECTION OF SOLIDS** **9+6**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to Horizontal plane (HP) only.

UNIT III **SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** **9+6**

Sectioning of above solids in simple vertical position by cutting planes inclined to Horizontal plane (HP) and perpendicular to the VP – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids inclined to Horizontal plane (HP) only – Prisms, pyramids, cylinders and cones

UNIT IV ISOMETRIC AND PERSPECTIVE PROJECTIONS 9+6

Isometric Projections

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones when cutting plane inclined to Horizontal plane (HP) only.

Perspective Projections (Not for Examination)

Perspective projection of prisms, pyramids and cylinders by visual ray method.

UNIT V ORTHOGRAPHIC PROJECTION 9+6

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills of multiple views from pictorial views of objects.

TOTAL 45 (L) + 30 (T) = 75 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply the knowledge of First angle projection to draw the projection of points, straight lines and planes. [Apply]
2. Draw the Projection of different simple solids. [Apply]
3. Draw the section of solids and development of lateral surfaces of solids. [Apply]
4. Apply the knowledge of Isometric projection to draw the objects like truncated solids and frustum. [Apply]
5. Sketch the orthographic views from the given pictorial (isometric) view [Apply]

TEXT BOOKS:

1. Natarajan K.V., “A Text book of Engineering Graphics”, Dhanalakshmi Publishers, (2006).
2. Bhatt N.D., “Engineering Drawing”, 46th Edition, Charotar Publishing House, (2003).

REFERENCE BOOKS:

1. Venugopal K., and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, (2008).
2. Gopalakrishnan K.R., “Engineering Drawing” (Vol .I&II), Subhas Publications,(1998).
3. DhananjayA.Jolhe, “Engineering Drawing with an introduction to Auto CAD”, Tata McGraw Hill Publishing Company Limited, (2008).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3		2						2				1	
CO.2	3		2						2				1	
CO.3	3		2						2					
CO.4	3		2						2				1	
CO.5	3		2						2				1	

COMPUTER PROGRAMMING LABORATORY

15UCS109	L	T	P	C
(Common to ALL Branches)				
	0	**0**	**2**	**1**

OBJECTIVES :

- To make the students to work with Office software.
- To familiarize the implementation of programs in C.

LIST OF EXPERIMENTS

a) **Word Processing**

Document creation, Formatting, Table Creation, Mail merge

b) **Spread Sheet**

Chart - Line, XY, Bar and Pie, Formula - formula editor.

c) **C Programming**

- Programs using simple statements
- Programs using decision making statements
- Programs using looping statements
- Programs using one dimensional and two dimensional arrays
- Solving problems using string functions
- Programs using user defined functions and recursive functions
- Programs using pointers
- Programs using structures and unions

TOTAL : 30 PERIODS

****

COURSE OUTCOMES:

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

- Use word processing and spreadsheet software for creating documents. (Apply)
- Develop computer applications using suitable control structures. (Analyze)
- Employ suitable derived data constructs to the solution of computing problems. (Apply)
- Create applications by utilizing structures and unions. (Create)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS.

SOFTWARE

OS – UNIX CLONE **(License free Linux)**

APPLICATION PACKAGE – OFFICE SUITE

COMPILER – C

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3								2	2		2		
CO.2	3	3	3						2	2		2		
CO.3	3	2	2						2	2		2		
CO.4	3	3	3						2	2		2		

		L	T	P	C
	ENGINEERING PRACTICES LABORATORY				
15UME110	**(Common to Mech, EEE, Civil, Chemical, Agricultural and Bio medical)**	**0**	**0**	**2**	**1**

OBJECTIVES :

- To demonstrate the plumbing and carpentry works.
- To train the students to perform welding and drilling operations.
- To demonstrate residential house wiring, fluorescent lamp wiring, measurement of earth resistance, colour coding of resistors, logic gates and soldering.

GROUP A (CIVIL & MECHANICAL)

CIVIL ENGINEERING PRACTICE **6**

LIST OF EXPERIMENTS :

1) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2) Preparation of plumbing line sketches for water supply and sewage works.
3) Hands-on-exercise: Basic pipe connections–Mixed pipe material connection Pipe connections with different joining components.
4) Demonstration of plumbing requirements of high-rise buildings.
5) Study of the joints in roofs, doors, windows and furniture.
6) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

MECHANICAL ENGINEERING PRACTICE **9**

LIST OF EXPERIMENTS :

1) Preparation of arc welding of butt joints, lap joints and tee joints.
2) Drilling Practice
3) Model making – Trays, funnels, etc.
4) Study of Different type of joints.
5) Study of centrifugal pump
6) Study of air Conditioner

A minimum of Five experiments shall be offered in GROUP A (CIVIL & MECHANICAL)

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICE **7**

LIST OF EXPERIMENTS :

(a) Residential house wiring using switches, fuse, indicator, lamp and energy meter and Stair case wiring

(b) Fluorescent lamp wiring.

(c) Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE **8**

LIST OF EXPERIMENTS :

(a) Study of Electronic components and equipments – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms, period, frequency) using CRO.

(b) Study of logic gates AND, OR, EX-OR and NOT Gate.

(c) Soldering practice – Components, Devices and Circuits – Using general purpose PCB.

Total : 30Periods

COURSE OUTCOMES:

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

1. Apply the basic knowledge of plumbing to make simple house hold pipe line connections. [Apply]
2. Fabricate the given components using carpentry, sheet metal & welding equipment/tools. [Apply]
3. Perform the operations like machining, drilling and Tapping. [Apply]
4. Apply basic electrical engineering knowledge for house wiring practice. [Apply]
5. Apply the knowledge of basic electrical engineering to practice soldering using general purpose PCB. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3								3	2				
CO.2	3								3					
CO.3	3								3	3				
CO.4	3								3	3				
CO.5	3								3	3				

EQUIPMENT REQUIREMENT

CIVIL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Assorted components for plumbing consisting of metallic Pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings	5 sets
2.	Carpentry vice (fitted to workbench)	15 Nos
3.	Standard working tools	15 sets
4.	Models of industrial trusses, door joints, furniture joints	5 each
5.	Power tool rotary hammer	2 Nos
6.	Demolition hammer	2 Nos
7.	Planer	2 Nos
8.	Hand drilling machine	2 Nos
9.	Jigsaw	2 Nos

MECHANICAL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Arc welding transformer with cables and holders	5 Nos
2.	Welding booth with exhaust facility	5 Nos
3.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 sets
4.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit	2 Nos
5.	Smithy tools	2 sets
6.	Moulding table, foundry tools	2 sets
7.	Study-purpose items: centrifugal pump, air-conditioner	One Each

ELECTRICAL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Assorted electrical components for house wiring	15 sets
2.	Electrical measuring instruments	10 sets
3.	Megger (250V/500V)	1 No
4.	Study purpose items: Iron box, fanand regulator, emergency lamp	One each
5.	Power Tools: (a) Range Finder (b) Digital Live-wire detector	 2 No 2 No

ELECTRONICS ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1.	Logic trainer kit	2 No
2.	CRO,AFO	2 Each
3.	Small multipurpose PCBs	10 No
4.	Soldering guns	10 No
5.	Multimeters	5 No
6.	Assorted electronic components for making circuits	Required quantity

15UGS112	BASIC SCIENCES LABORATORY I (Common to ALL Branches)	L	T	P	C
		0	0	2	1

Objectives

- To create scientific Temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments

PHYSICS LABORATORY

LIST OF EXPERIMENTS

(Common to All Branches)

1. Laser – Determination of particle size and wavelength of Laser source using Diode Laser.
2. Ultrasonic Interferometer Determination of velocity of sound and compressibility of liquid.
3. Poiseuille's method - Determination of Coefficient of viscosity of liquid.
4. Spectrometer – Determination of dispersive power of a prism.
5. Compound pendulum – Determination of the acceleration due to gravity
6. Air Wedge method - Determination of thickness of a thin wire.

- **A minimum of FIVE experiments shall be offered**

COURSE OUTCOMES:

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

- Apply the principles of optics, laser physics and elasticity to determine the engineering properties of materials. [Apply]
- Analyze the given liquid sample to determine the viscosity and compressibility of the liquid. [Analyze].
- Apply the principles of spectroscopy to determine the properties using prism. [Apply]

Laboratory classes on alternate weeks for Physics and Chemistry

CHEMISTRY LABORATORY

OBJECTIVES:

- To impart knowledge on basic concepts in application of chemical analysis
- To train the students to handle various instruments.
- To acquire knowledge on the chemical analysis of various metal ions.

LIST OF EXPERIMENTS

(common to ECE,EEE,CSE,IT, &Biomedical Engg)

1. Preparation of molar and normal solutions of the following substances – Oxalic acid, Sodium Carbonate, Sodium Hydroxide and Hydrochloric acid.
2. Conductometric Titration of strong acid with strong base
3. Estimation of Iron by potentiometry
4. Determination of Strength of given acid using pH metry
5. Determination of molecular weight of polymer by viscometry
6. Comparison of the electrical conductivity of two samples-conductmetric method
7. Estimation of copper in brass by EDTA method

A minimum of FIVE experiments shall be offered for every course

TOTAL: 30 PERIODS

Course Outcomes:

At the end of the course, the student will able to

- Prepare solutions on various concentrations. [Apply]
- Analyze the given solution quantitatively using chemical and electro analytical methods. [Analyze]
- Determine the amount and molecular weight of the given substances. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3								3				2	
CO.2	3								3				2	
CO.3	3								3					
CO.4	3								3					
CO.5	3	3							3					
CO.6	3								3					

15UEN201	BUSINESS ENGLISH & PRESENTATION SKILLS (Common to ALL Branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To use linguistic tools confidently in an English speaking context
- To listen and speak during normal business activities such as interviews, meetings, telephone conversations and negotiations.
- To write business letters, emails, reports, articles and comprehend information on the Internet and other media.
- To gain language skills for real business life situations

Unit – I **9**

Grammar- Numerical Adjective; **Vocabulary** - Job title and describing jobs; **Listening** - Listening to company culture; **Reading** - Quiz; **Writing** - Writing formal and semi formal business letters; **Speaking** – Personal information, Companies and products.

Unit – II **9**

Grammar –Modals; **Vocabulary –** Collocations; **Listening** - Business Proceedings; **Reading** - Designing websites and e– mail ; **Writing** – Memo - **Speaking -** Role play on various business situation.

Unit – III **9**

Grammar – prepositions – Articles; **Vocabulary –**Jargons related to Shares and stock; **Listening** – Interviews of celebrities; **Reading –** Shares and stock exchange transactions; **Writing** – Business report – Minutes of the Meeting; **Speaking** – Presentations, Making a business talk.

Unit – IV **9**

Grammar - Connectives; **Vocabulary** –Words related to finance; **Listening** - Listening to statistical information; **Reading** - Interpreting business related bar charts; **Writing** - Letters to express interest in new products; **Speaking** - Presenting a summary of an article.

Unit - V **9**

Grammar - Reported speech; **Vocabulary** – Words related to employment ; **Listening**- Listening to audio and video speech of business people; **Reading** - Reading News paper article/magazine articles on business; **Writing** - Writing a Proposal; **Speaking** - Discussing company policies.

TOTAL: 45(L) = 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

- Build business vocabulary to present the ideas in various business scenarios. [Create]
- Interpret verbal and non verbal communications to respond to formal situations. [Understand]
- Develop letter writing skills to present their ideas for various business situations. [Create]
- Write Business Proposals and Business Reports for various business purposes. [Create]
- Present the concepts with clarity for various business situations. [Create]

TEXT BOOK:

M.Dhanasekaran: Business English & Presentation Skills, Rathna Arts,Sivakasi, 2018.

REFERENCE BOOKS:

1. B.A.Elankathiravan: Business English & Presentation Skills,Wakeup Publication, Sivakasi,2017
2. Allan Pease, Body Language, New Delhi, Sudha Publications (P) Ltd, 2005.
3. Malcolm Goodale, Professional Presentations, New Delhi, Cambridge University Press, 2006.
4. Randolph Hudson. H & Bernard Selzler. J. Business Communication, Jaico Publishing House, 2006

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1									2	3		3		
CO.2									2	3		3		
CO.3									2	3		3		
CO.4									2	3		3		
CO.5									2	3		3		

ENGINEERING MATHEMATICS – II

15UMA202

L	T	P	C
3	2	0	4

(Common to ALL Branches)

OBJECTIVES :

- To develop an understanding of the basics of vector calculus comprising of gradient, divergence and curl, and line, surface and volume integrals and the classical theorems involving them.
- To acquaint the student with the concepts of analytic functions and their interesting properties which could be exploited in a few engineering areas, and be introduced to the host of conformal mappings with a few standard examples that have direct application.
- To make the student acquire sound knowledge of Laplace transform and its properties and sufficient exposure to the solution of certain linear differential equations using the Laplace transform technique.

UNIT I **ANALYTICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **8 + 6**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Applications of ODE (Bacterial growth, Population growth, Decayed problems).

UNIT II **VECTOR CALCULUS** **8 + 6**

Gradient Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopiped.

UNIT III **ANALYTIC FUNCTIONS** **8 + 6**

Functions of a complex variable – Analytic function – Necessary and Sufficient Conditions (excluding Proofs) – Harmonic function - Properties of an analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+c$, cz, $1/z$, and Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9 + 6

Statement and applications of Cauchy's integral theorem, Cauchy's integral formula and Cauchy Residue Theorem – Taylor's and Laurent's expansions – Applications of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding Poles on the real axis).

UNIT V LAPLACE TRANSFORM 9 + 6

Existence conditions – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function, impulse function and periodic function - Inverse Laplace transform – Convolution theorem (excluding Proof) –Solution of linear ODE of second order with constant coefficients.

SUPPLEMENT TOPIC (for internal evaluation only) 3

Evocation / Application of Mathematics, Arithmetical, Ability – Time and Work – Time and Distance.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

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

- Solve first and higher order ordinary differential equations analytically. [Apply]
- Calculate the gradients and directional derivatives for scalar valued and vector valued functions. [Apply]
- Find the image of a region under conformal mapping and construct analytic functions using its properties. [Apply]
- Determine the nature and extent of singularities of functions. [Apply]
- Apply Laplace Transform methods to solve initial value problems for constant coefficient linear ordinary differential equations. [Apply]

TEXT BOOKS:

1. Veerarajan.T"Engineering Mathematics"Tata McGraw Hill Publishing Company, New Delhi,vol 15.
2. Bali N. P and MANISH GOYAL, "Text book of Engineering Mathematics", Laxmi Publications (P) Ltd., New Delhi, 3rd Edition, (2008).

REFERENCE BOOKS:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, (2011).
3. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House Pvt. Ltd., New Delhi, 3rd Edition, (2007).
4. Agarwal R.S., "Quantitative Aptitude", S. Chand Publications, New Delhi, 7th Edition, (2008), pp. 341-370, 384-404.
5. Grewal. B.S,"Higher Engineering Mathematics", Khanna Publications, New Delhi, 43rd Edition, (2014).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3			1								2	2	
CO.2	3			1								2	2	
CO.3	3			1								2	2	
CO.4	3			1								2	2	
CO.5	3			1								2	2	

15UPH204	SOLID STATE PHYSICS (Common to EEE & Biomedical branches)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To identify the fleet of scientific channels exploring the generation of high-tech electrical engineering materials.
- To enable the students to understand the properties of superconducting and magnetic materials
- To provide a comprehensive overview of nanomaterials in terms of the synthesis, characterization, properties, and applications.

UNIT I ELECTRICAL PROPERTIES OF SOLIDS 9

Introduction - Derivation of microscopic form of Ohm's law- postulates of classical free electron theory-derivation of electrical conductivity of metals (Drude- Lorentz theory)- merits and demerits. Derivation of thermal conductivity – Wiedemann-Franz law- verification - Density of energy states.

UNIT II SEMICONDUCTING AND BIOMATERIALS 9

Introduction – Direct and Indirect band gap semiconductors – Intrinsic semiconductor – carrier concentration derivation –Extrinsic semiconductor (qualitative) – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC & SUPERCONDUCTING MATERIALS 9

Introduction– Bohr magnetron – Classification of magnetic materials – Domain theory – Hysteresis – soft and hard magnetic materials–Superconductivity: Properties - Types of super conductors – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications – SQUID – Maglev

UNIT IV DIELECTRICS AND CERAMICS 9

Dielectric Materials: Introduction – Electrical susceptibility-Dielectric constant-Electronic, ionic, orientation and space charge polarization –Internal field – ClaussiusMosotti relation (Derivation). Ceramic Materials: Introduction - Classification – Structure – Methods of Processing – Properties – Application.

UNIT V NANO MATERIALS 9

Introduction to nano materials –fabrication method- synthesis – Top-down and bottom up approach – Plasma arching- Chemical Vapour deposition - ball milling –sol gel method- properties of nanoparticles - Nanomaterial's application in Biomedical

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Explain the concepts of electrical conductivity using ohm's law and wiedmenn- franz law. [Understand]
- Determine the type of semiconductors using Hall effect. [Apply]
- Explain the properties of magnetic and superconducting materials. [Understand].
- Explain the properties of dielectric and Engineering ceramic material. [Understand].
- Describe the synthesis, properties and applications of nanomaterials. [Understand]

TEXT BOOKS:

1. William D. Callister, Jr. "Material Science and Engineering", Seventh Edition, John Wiley & Sons Inc. New Delhi, 2010
2. Dr. Mani.P ,"Engineering Physics II ", Dhanam Publications, Chennai Revised Edition, 2014.
3. V. Rajendran, Materials Science, Tata McGraw-Hill, New Delhi, 2014.

REFERENCE BOOKS:

1. Kingery W.D., Bowen H.K. and Dr. Uhlmann, "Introduction to Ceramics', Second Edition, Wiley and son's, Revised Edition 2012.
2. Raghavan.V, "Material Science and Engineering", Prentice Hall of India Private Limited, New Delhi, Revised Edition 2013.
3. Palanisamy P.K., "Engineering Physics', Scitech Publication, Chennai, Edition, 2014.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2												2	2
CO.2	3												2	2
CO.3	2												2	2
CO.4	2												2	2
CO.5	2												2	2

15UCY207	ENVIRONMENTAL SCIENCE (Common to ALL Branches)	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understanding the concepts of ecosystem and biodiversity.
- Acquire knowledge about the impact of environmental pollution.
- Awareness on various types of resources.
- Understand the importance of environmental issues in the society.
- Awareness about the impact of environment related to human health.

MODULE-I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – Need for public awareness – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

MODULE-II ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: Causes, effects and control measures of municipal solid wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

MODULE-III FUTURE POLICY AND ALTERNATIVES 9

Future policy and alternatives-fossil fuels-nuclear energy-solar energy-wind energy-hydroelectric energy-geothermal energy-tidal energy-sustainability-green power-nanotechnology-international policy.

MODULE-IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization - Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation – Public awareness.

MODULE-V HUMAN POPULATION AND THE ENVIRONMENT 8

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health

COURSE OUTCOMES

After successful completion of this course the students will be able to:

- Express the concepts of ecosystem and biodiversity. [Understand]
- Describe the impact of environmental pollution. [Understand]
- Identify alternate energy sources for technological applications. [Understand]
- Explain the importance of environmental issues to the society. [Understand]
- Analyze the impact of environmental issues related to human health. [Analyze]

TEXT BOOKS

1. AnubhaKaushik, kaushik C.P., “Environmental Science and Engineering”, Third Edition, New Age International, New Delhi, 2009.
2. Benny Joseph “Environmental Science and Engineering”, Tata Mc-Graw Hill, New Delhi, 2006.

REFERENCE BOOKS:

1. Gilbert M.Masters, ‘Introduction to Environmental Engineering and Science’, Pearson Education,Upper saddle River, New Jersey, 2008.
2. Miller T.G. Jr., Environmental Science”, Wadsworth Publishing Company, Belmont, California, 2005.
3. De A.K., “Environmental Chemistry”, Wiley Eastern Ltd., New Delhi, 2001.
4. Trivedi R.K., Goel P.K., “Introduction to Air Pollution”, Techno-Science Publication, Jaipur, 2005.

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2					2	3					3		
CO.2	2					2	3					3		
CO.3	2					2	3					3		2
CO.4	2					2	3					3		
CO.5	3	3				2	3					3		

15UME208	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
	(Common to MECH & EEE)	3	0	0	3

OBJECTIVES :

- To understand the fundamentals of thermal systems
- To understand the basics of building construction and infrastructures

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying:

Objects – types – classification – principles – measurements of distances – angles –leveling – determination of areas – illustrative examples.

Civil Engineering Materials:

Bricks – stones – sand – cement – concrete – steel sections

UNIT II BUILDING COMPONENTS AND STRUCTURES 9

Foundations:

Types, bearing capacity – Requirement of good foundations - Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING 9

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV IC ENGINES 9

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Summarize the measurement of landscape and different building materials with norms. [Understand]
- Classify the different building structure and its applications relevant to civil engineering practice. [Analyze]
- Interpret the ideas of variety of energy sources considering the norms of engineering practice. [Understand]
- Explain the working principle of I.C engines. [Understand]
- Discuss the working principle of Refrigeration and Air conditioning systems. [Understand]

TEXT BOOKS:

1. Shanmugam G. and Palanichamy M.S., “Basic Civil and Mechanical Engineering”, Tata Mc-Graw Hill Publishing Co., New Delhi, (1996).
2. Venugopal K., Prabhu Raja V., and Sreekanjana G., “Basic Civil and Mechanical Engineering”, Anuradha Publications, Third Edition (2010).

REFERENCE BOOKS:

1. Ramamrutham S., “Basic Civil Engineering”, DhanpatRai, Publishing Co. (P) Ltd, (1999).
2. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, (2005).
3. Shantha Kumar S.R.J., “Basic Mechanical Engineering”, Hi-Tech Publications, Mayiladuthurai, (2000).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2					3	2							
CO.2	2					3	3							
CO.3	2					2	2							2
CO.4	2												2	
CO.5	2					2								

15UEE209	ELECTRIC CIRCUITS	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES :

- To introduce the basic concepts of single phase, three phase and DC Electrical circuits
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations
- To introduce the methods of circuit analysis using Network theorems

UNIT I BASIC CIRCUIT ANALYSIS **6+6**

Electrical quantities - current, voltage, power , active and passive elements, Energy, Circuits and circuit elements - Voltage and current source Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS **6+6**

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Nortons Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem - Principle of duality and dual networks.

UNIT III RESONANCE AND COUPLED CIRCUITS **6+6**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits

UNIT IV TRANSIENT RESPONSE FOR DC AND AC CIRCUITS **6+6**

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V ANALYSING THREE PHASE CIRCUITS 6+6

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – Phasor diagram of voltages and currents – power and power factor measurements in three phase circuits

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

- Apply basic circuit laws to compute the electrical quantities in DC and AC circuits.[Apply]
- Apply network reduction techniques and network theorems for solving DC and AC circuits. [Apply]
- Compute the performance of resonance and coupled circuits. [Apply]
- Analyze the transient response of dc and ac circuits to solve complex electrical engineering problems. [Analyze]
- Analyze the power and power factor in three phase circuits under different loads. [Analyze]

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”,Tata McGraw Hill publishers, 8th edition, New Delhi, 2012.
2. Arumugam M. and Premkumar N., “ Electric circuits theory ”, Khanna publihsers, 7th edition, New Delhi,2007.

REFERENCE BOOKS:

1. Sudhakar A .and Shyam Mohan SP., “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 3rd edition 2007.
2. Paranjothi SR., “Electric Circuits Analysis”, New Age International Ltd.,3rd edition New Delhi,2010.
3. Joseph A. Edminister and Mahmood Nahri, “Electric circuits”, Schaum’s series, Tata McGraw-Hill,5th edition New Delhi (2013).
4. Chakrabati A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 2008.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2										3	2	2
CO.2	3	2										3		2
CO.3	3	2										3		2
CO.4	3	3		2								3	3	3
CO.5	3	3										3	3	3

15UGS210	BASIC SCIENCES LABORATORY –II (Common to ALL Branches)	L	T	P	C
		0	0	2	1

Objectives:

- To introduce the experimental procedure for the Band gap of a semiconductor, B-H curve and Potentiometer.
- To demonstrate the working of Spectrometer and Lee's Disc apparatus.

PHYSICS LABORATORY

(COMMON TO CSE, ECE, EEE, IT, BIOMEDICAL)

LIST OF EXPERIMENTS

1. Laser – Determination of numerical aperture and acceptance angle of an optical fibre.
2. Carey Foster's Bridge – Determination of specific resistance of the given coil.
3. Spectrometer – Determination of wavelength of mercury source using grating.
4. Newton's ring – Determination of radius curvature of convex lens.
5. B-H curve - Study of Hysteresis Loop
6. Determination of Band gap of a semiconductor.

A minimum of FIVE experiments shall be offered

COURSE OUTCOMES:

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

- Apply the principles of Optics, Laser physics and spectroscopy to determine the Engineering properties of materials. [Apply]
- Determine the thermal conductivity of the given material. [Apply]
- Determine the energy gap and specific resistance of the given material. [Apply]

CHEMISTRY LABORATORY

OBJECTIVES:

- Develop the practical skills to evaluate the quality parameters of water and industrial effluents
- Apply the theoretical principles and perform experiments**.**

LIST OF EXPERIMENTS

(Common to All Branches)

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of Chloride in water sample (Argentometric method)
4. Determination of DO in water
5. Estimation of silver ion by Dichrometry
6. Determination of quality of Surface water (River/pond/lake) and Ground water (well/ bore well) with respect to Hardness, TDS, Chloride and pH.
7. Determination of acidity of industrial effluents.

A minimum of FIVE experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will able to

- Test and analyze the water quality parameters for the given sample. [Analyze]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3								3					
CO.2	3								3					
CO.3	3								3					
CO.4	3	3				3	3		3			2		2

15UEE211	ELECTRIC CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE :

- To familiarize various theorems, resonance circuits, measurement of three phase powers and calculation of two port network parameters.

LIST OF EXPERIMENTS

1. Verification of Ohm's Law and Kirchoff's Laws
2. Verification of Thevenin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Verification of mesh and nodal analysis.
7. Frequency response of series and parallel resonance circuits.
8. Measurement of time constant for RL, RC and RLC circuits.
9. Measurement of energy using single phase energy meter.
10. Measurements of three phase power using two wattmeter methods.
11. Determination of two port network parameters
12. Determination of self, mutual inductances and co-efficient of coupling.

A minimum of TEN experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Apply basic circuit laws and network theorems to compute the electrical quantities in electric circuits. [Apply]
- Analyze the frequency response of resonance circuits for various bandwidths. [Analyze]
- Analyze the transient response of RL, RC & RLC circuits for various switching conditions. [Analyze]
- Calculate single phase and three phase power, power factor and energy under different loads. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2	2						3	2			2	2
CO.2	3	3	2						3	2				
CO.3	3	3	2						3	2			2	3
CO.4	3	2	2						3	2			2	2

HARDWARE REQUIREMENT:

S.NO.	Description of the Equipment	Quantity Required
1	DC- Regulated Power supply	8
2	Voltmeter	5
3	Wattmeter	4
4	Ammeter	13
5	DRB(Variable Resistor)	4
6	DIB(Variable Inductor)	3
7	DCB(Variable Capacitor)	3
8	Function Generator	3
9	Multimeter	1
10	Stop Watch	1
11	SPDT Switch	1
12	3-Phase Variac	1
13	1-Phase Variac	1
14	CRO	2
15	Resistive Load (3-Phase)	1
16	Single –Phase Transformer 1 KVA	1
17	Resistors, Capacitors and Inductors	(as required)

15UMA321 **TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to MECH, ECE, EEE, CIVIL, CHEMICAL, AGRI, BIO MEDICAL)**

L	T	P	C
3	2	0	4

OBJECTIVES :

- To make the student knowledgeable in formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- To familiarize the students to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them numerically and interpret the results.
- To acquaint the student with the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

UNIT I FOURIER SERIES **9 + 6**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic analysis

UNIT II FOURIER TRANSFORM **9+ 6**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity -

UNIT III Z-TRANSFORM AND DIFFERENCE EQUATIONS **9+ 6**

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value Theorems - Formation of difference equations – Solution of difference equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS **9 + 6**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations – Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and

non-homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+ 6

Introduction of Partial differential equations - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

TOTAL : 45 (L) + 30 (T) = 75 PERIODS

Supplement Topic- Application of Fourier series - Gibb's ,Application of Fourier Transform Phenomenon

COURSE OUTCOMES:

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

- Write any periodic function as a combination of series of sine and cosine which are harmonically related to each other. [Apply]
- Apply the knowledge of Fourier transform and its properties to transform signals between time and frequency domain. [Apply]
- Apply the knowledge of Z transform and its properties to analyze linear discrete systems. [Apply]
- Develop partial differential equation and solve linear first order and second order partial differential equations. [Apply]
- Apply Fourier series to solve partial differential equations representing one dimensional and two dimensional heat and wave equations. [Apply]

TEXT BOOKS:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 42nd Edition, (2012).
2. Kandasamy.P, Thilagavathy.K, and Gunavathy.K, Engineering Mathematics III, S.Chand & Company Ltd., New Delhi, 3rd Edition, (1996).

REFERENCE BOOKS:

1. Bali N.P., MANISH GOYAL and WATAINS, “Advanced Engineering Mathematics”, Firewall Media (An imprint of Laxmi Publication Private limited) New Delhi, 7th Edition, (2009).
2. Ramana.B.V, “Higher Engineering Mathematics” Tata McGraw Hill, New Delhi, 11th Reprint (2010).
3. Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, New Delhi, 3rd Edition, (2007).
4. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India, 10th Edition, (2011).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3			1								1	2	2
CO.2	3			1								1	2	2
CO.3	3	3		1								1	2	2
CO.4	3			1								1	2	2
CO.5	3			1								1	2	2

15UEE302	DC MACHINES AND TRANSFORMERS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To introduce techniques of magnetic-circuit analysis and introduce magnetic materials
- To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- To study the working principles of DC machines as Generator types, determination of their noload/load characteristics, starting and methods of speed control of motors.
- To estimate the various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 12

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysterisis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 12

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer– parallel operation of three phase transformers-auto transformer – tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 12

Energy in magnetic system – Field energy and coenergy-force and torque equations – singly and multiply excited magnetic field systems-mmf of distributed windings – Winding Inductances-magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 12

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation-commutation and interpoles - compensating winding –characteristics of DC generators.

UNIT V DC MOTORS 12

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors-starting and speed control of DC motors –Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent magnet dc motors (PMDC)- DC Motor applications.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

- Apply the laws of magnetic circuits and properties of magnetic materials for the design of electrical machines. [Apply]
- Analyze the performance of transformers by conducting various tests. [Analyze]
- Apply the concepts of electromechanical energy conversion and design of rotating machines for various applications. [Apply]
- Analyze the performance characteristics of generators and select suitable generator for various applications. [Analyze]
- Analyze the performance characteristics of motors and select suitable motor for various applications. [Analyze]

TEXT BOOKS:

1. Kothari D.P., Nagrath I.J, " Electric Machines ", Tata McGraw Hill, 2009.
2. Bimbhra., "Electrical Machinery" ,Khanna Publishers, 2003

REFERENCE BOOKS:

1. Fitzgerald A.E. and Charles Kingsley and Stephen D.Umans, "Electric Machinery", Tata McGraw Hill., 2003.
2. Gupta J.P. , " Theory and Performance of Electrical Machines" ,S.K.Kataria and Sons, 2010
3. Theraja B.L.,"A Text Book of Electrical Technology Vol. II ", S.Chand& Co. Ltd, 2008
4. Murugesh Kumar K.,"DC Machines and Transformers ", Vikas publishing house Pvt Ltd, 2004.
5. Mehta. V.K., " Principles of Electrical Machines ", S.Chand & Co. Ltd, 2007.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2										3	2	
CO.2	3	3										3	2	
CO.3	3	2	2									3	2	
CO.4	3	3	2									3	3	
CO.5	3	3	2									3	3	

15UEE303	FIELD THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on vector fields - electrostatic and magneto static fields, concepts of electrodynamics and electromagnetic waves.

UNIT I INTRODUCTION 9

Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems- vector calculus – Gradient, Divergence and Curl - Divergence theorem – Stoke's theorem.

UNIT II ELECTROSTATICS 9

Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's law and application – Electric potential – Electric field due to infinite line charge , charged circular ring - Equipotential plots –Dielectric polarization - Dielectric strength – Boundary condition between conductor and free space- Poisson's and Laplace's equations – Capacitance- Energy density.

UNIT III MAGNETOSTATICS 9

Lorentz Law of force, magnetic field intensity – Biot-savart Law - Ampere's Law – Magnetic field due to straight conductors, circular loop – Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization – Boundary conditions – Scalar and vector potential – Magnetic force – Torque – Inductance – Energy density

UNIT IV ELECTRODYNAMIC FIELDS 9

Faraday's laws, induced emf – Transformer and motional EMF – Forces and Energy in quasi-stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory and circuit theory.

UNIT V ELECTROMAGNETIC WAVES 9

Generation – Electro Magnetic Wave equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors-skin depth, Poynting vector – Plane wave reflection and refraction – Transmission lines – Line equations – Input impedances – Standing wave ratio and power

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply Vector calculus to static Electric – Magnetic fields for different coordinate systems. [Apply]
- Apply Coulomb's law and Gauss's law to determine Electric field for different charge distributions and associated boundary conditions. [Apply]
- Apply Biot-Savart's law and Ampere's law to find Magnetic field for different media and associated boundary conditions. [Apply]
- Apply the knowledge of Faraday's law and Maxwell's equation for realizing the operation of electrical machines. [Apply]
- Compute the electromagnetic wave parameters for analyzing transmission lines. [Apply]

TEXT BOOKS:

1. Matthew N.O. Sadiku., "Elements of Electromagnetics ", Oxford University press, First Edition, 2007.
2. William .H. Hayt, "Engineering Electromagnetics ", Tata McGraw Hill edition Ltd, 2001.

REFERENCE BOOKS:

1. Joseph A. Edminister, "Theory and Problems of Electromagnetics", Schaum Series, Tata McGraw Hill, second Edition, 1993.
2. Kraus and Fleish, "Electromagnetics with Applications", McGraw Hill International Editions, Fifth Edition, 1999.
3. Ashutosh Pramanik, "Electromagnetism – Theory and Applications", Prentice-Hall of India Private Limited, 2006
4. Clayton R. Paul., Keith W. Whites. and Syed A. Nasar, "Introduction to Electromagnetic Fields", Tata McGraw Hill, third Edition, 2007.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2	2									3	2	
CO.2	3	2										3		
CO.3	3	2	2									3	3	
CO.4	3	2										3	2	
CO.5	3	2										3		

15UEE304	POWER SYSTEM GENERATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on Power Plants
- To discuss the role of Electrical Engineers in their operation and maintenance

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CA Nada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain the layout and operation of coal based thermal power plants. [Understand]
- Illustrate the functions of Diesel, Gas turbine and Combined Cycle power plants. [Understand]
- Outline the operation of Nuclear power plants with appropriate consideration of safety measures. [Understand]
- Summarize the need and operation of renewable energy sources for sustainable development. [Understand]
- Identify the energy, economic and environmental issues in power plants. [Apply]

TEXT BOOKS:

1. Nag P.K., “Power Plant Engineering", Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2008.
2. Arora Domkundwar, “ A Course in Power Plant Engineering ”, Dhanpat Rai and Co.Pvt.Ltd.

REFERENCE BOOKS:

1. El-Wakil M.M., “Power Plant Technology”, Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, “Power Plant Engineering”, Springer, 1996.
3. Thomas C. Elliott., Kao Chen, and Robert C. Swanekamp, “Standard Handbook of Power Plant Engineering”, Second Edition, McGraw – Hill, 1998.
4. Godfrey Boyle, “Renewable energy, Open University, Oxford University Press in association with The Open University”, 2004.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2					2	2							
CO.2	2					2	2					2		
CO.3	2					3	2							
CO.4	2					2	3					2		2
CO.5	3	2				3	3					2		

15UEE305	SEMICONDUCTOR DEVICES AND CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the construction, theory and characteristics of the various electronic devices
- To familiarize with the applications of semiconductor diodes and transistors

UNIT I SEMICONDUCTOR DIODE AND ITS APPLICATIONS 9

PN junction diode-VI characteristics – Rd, temperature effects – Drift and diffusion currents – switching characteristics – Rectifiers: HWR, FWR, BR - Filters- Zener diode – VI characteristics, Regulators (series and shunt), LED, LCD characteristics and applications

UNIT II BJT AND ITS APPLICATIONS 9

Bipolar Junction Transistor – Transistor construction – Input and output characteristics – CE, CB and CC configurations – relationship between α, β and γ - hybrid model – Analytical expressions – switching characteristics – RF application – Power transistors – Opto couplers.

UNIT III FET AND ITS APPLICATIONS 9

JFET – Characteristics and parameters – small signal model – LF and HF equivalent circuits – CS and CD amplifiers –cascade and cascade amplifiers – Darlington connection – MOSFET - Enhancement and Depletion – Characteristics

UNIT IV AMPLIFIERS AND OSCILLATORS 9

Differential amplifiers: CM and DM –Single tuned amplifiers-Feedback amplifiers – Power amplifier (Qualitative analysis) -stability – Voltage /current, series / shunt feedback – Oscillators – Condition for oscillation – LC-Hartley, Colpitts and Clapps, RC-Phase shift and Wein Bridge, Crystal oscillator.

UNIT V PULSE CIRCUITS 9

RC wave shaping circuits – Diode clippers and clampers – Multivibrators-astable, monostable and Bistable – Schmitt triggers – UJT based saw tooth oscillators

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze the characteristics of diodes and select suitable diode for various applications. [Analyze]
- Analyze the characteristics of BJT and select suitable configuration for various applications. [Analyze]
- Analyze the characteristics of FET for the design of amplifiers. [Analyze]
- Analyze the characteristics of differential amplifiers and oscillators for designing signal conditioning circuits. [Analyze]
- Select suitable semiconductor device for constructing wave shaping and multivibrator circuits. [Apply]

TEXT BOOKS:

1. David Bell, “Electronic Devices and Circuits ”, PHI, 2007.
2. Millman and Halkias, “Electronic Devices and Circuits ”, Tata McGraw– Hill, 2007.
3. Floyd. T.L., “Electronic Devices”, Pearson Education, VI Edition, 2003.

REFERENCE BOOKS:

1. Paynter, “Introductory electronic devices and circuits ”, PHI.,2006.
2. Mottershead A., “Electronic Devices and Circuits an Introduction”, Prentice Hall of India,
3. Singh B.P. and Rekha Singh, “Electron devices & Integrated Circuits”, Pearson Education, 2006.
4. Theodre. F. Boghert , “Electronic Devices and Circuits ”, Pearson Education, VI Edition, 2003.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3							2		1	2		
CO.2	3	3	2						2		1	2		3
CO.3	3	3	2						2		1	2		3
CO.4	3	3							2		1	2		
CO.5	3											2		2

15UEE306	DIGITAL LOGIC CIRCUITS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To impart knowledge on the various number systems, Boolean functions and combinational circuits
- To explain synchronous, asynchronous sequential circuits and PLCs
- To introduce digital simulation for development of application oriented logic circuits

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 12

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code- Digital Logic Families, comparison of RTL, DTL, TTL, ECL and MOS families - operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 12

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations – minimization using K maps - simplification and implementation of combinational logic – multiplexers and demultiplexers - code converters, adders, subtractors.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 12

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous Sequential circuits – Moore and Mealy models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES 12

Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmable Logic Devices: PROM – PLA –PAL

UNIT V VHDL 12

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, Flip-flops, FSM Multiplexers / Demultiplexers).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Apply different types of number systems, codes and Boolean algebra for the design of digital logic circuits. [Apply]
- Design and realize the combinational circuits using logic gates. [Create]
- Design the synchronous sequential circuits using flip-flops. [Create]
- Design asynchronous sequential circuit and programming logic devices for given logic function. [Create]
- Develop VHDL code for combinational and sequential circuits. [Apply]

TEXT BOOKS:

1. Raj Kamal, “Digital systems-Principles and Design”, Pearson Education 2nd edition, 2007.
2. Morris Mano M., “Digital Design with an introduction to the VHDL”, Pearson Education, 2013.

REFERENCE BOOKS:

1. Mandal , “Digital Electronics Principles & Application”, McGraw Hill Edu, 2013.
2. Charles H. Roth and Jr.Lizy Lizy Kurian John, “Digital System Design using VHDL”, Cengage, 2013.
3. John M.Yarbrough, “Digital Logic, Application & Design”, Thomson, 2002.
4. Gaganpreet Kaur, “VHDL Basics to Programming”, Pearson, 2013.
5. Botros, “HDL Programming Fundamental”, VHDL& Verilog, Cengage, 2013.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3											3		
CO.2	3	3	3									2		
CO.3	3	3	3									2		
CO.4	3	3	3									2		
CO.5	3				2							3		

15UEE307	DC MACHINES AND TRANSFORMERS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To demonstrate the operation and performance characteristics of D.C. machines and transformers

LIST OF EXPERIMENTS:

1. Open circuit and load characteristics of separately and self excited DC shunt generators.
2. Load characteristics of DC compound generator with differential and cumulative connection.
3. Load characteristics of DC shunt and compound motor.
4. Load characteristics of DC series motor.
5. Swinburne's test and speed control of DC shunt motor.
6. Hopkinson's test on DC motor – generator set.
7. Load test on single-phase transformer and three phase transformer connections.
8. Open circuit and short circuit tests on single phase transformer.
9. Sumpner's test on transformers.
10. Separation of no-load losses in single phase transformer.
11. Study of Scott connection of Transformer.
12. Study of parallel operation of Transformer.
13. Study of Characteristics of Welding Transformer.

A minimum of TEN experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Examine the performance characteristics of generators and select suitable generator for various applications. [Analyze]
- Analyze the performance characteristics of motors and select suitable motor for various applications. [Analyze]
- Compute the regulation and efficiency of Transformers. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3				2		3	3	2			3	
CO.2	3	3				2		3	3	2			3	
CO.3	3					2			3	2			2	

HARDWARE REQUIREMENT :

S.No.	Description of Equipment	Quantity Required
1	**D.C motor – Generator set**	
	D.C motor – Shunt Generator	2 set
	D.C motor – Compound Generator	2 set
2	D.C. Shunt Motor	2 Nos.
3	D.C. Series Motor	1 No.
4	D.C. Compound Motor	1 No.
5	Single phase transformers	7 Nos.
6	Three phase transformers	2 Nos.
7	Resistive load single phase	3 Nos.
8	Single phase Auto transformer	5 Nos
9	Three phase auto transformer	1 No.
10	Moving Coil Ammeter of different ranges	20 Nos.
11	Moving Coil Voltmeter of different ranges	20 Nos.
12	Moving Iron Ammeter of different ranges	20 Nos.
13	Moving Iron voltmeter of different ranges	20 Nos.
14	Wire wound Rheostats of different ratings	30 Nos.
15	Tachometers	10 Nos.
16	Single element wattmeters of different ranges	10 Nos.

	UPF/LPF	
17	Double element wattmeters of different ranges	2 Nos.
18	Digital multimeter	2 Nos.
19	Frequency meter	1 No.
20	Three point starter, four point starter	1 No.(for each experiment)

15UEE308	SEMICONDUCTOR DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE

- To review the characteristics of semiconductor devices

LIST OF EXPERIMENTS:

1. Characteristics of Semiconductor diode and zener diode.
2. Characteristics of Transistor using various configurations.
3. Characteristics of FET.
4. Characteristics of UJT.
5. Characteristics of SCR, DIAC and TRIAC.
6. Photo diode, phototransistor Characteristics and study of light activated relay circuit.
7. Static characteristics of Thermistors.
8. Single phase half wave and full wave rectifiers with inductive and capacitive filters.
9. Differential amplifier using FET.
10. Study of CRO for frequency and phase measurement.
11. Realization of Passive filters.
12. Study of Resistance impact under series and parallel connection using MultiSim Simulator.
13. Study of Common Emitter amplifier using MultiSim Simulator.

A minimum of TEN experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Analyze the characteristics of semiconductor devices and select suitable device for various applications [Analyze]
- Examine the characteristics of rectifier circuits for the design of power supplies. [Analyze]

- Analyze the characteristics of FET for the design of amplifiers. [Analyze]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3			2			3	3	2				3
CO.2	3	3	3		2			3	3	2				3
CO.3	3	3						3	3	2				

HARDWARE REQUIREMENT:

S.No.	Description of Equipment	Quantity Required
1	Regulated Power Supply	15
2	Dual Trace CRO	15
3	Function Generator	15
4	Digital Multi meter	10
5	Bread Boards	40
6	Transistor (BC107)	25 Nos.
7	JFET (BFW10)	10 Nos.
8	Diode (1N4001)	10 Nos.
9	Zener Diode (4.7VZ)	5 Nos.
10	UJT (2N2422)	5 Nos.
11	Photo Diode	5 Nos.
12	Photo Transistor	5 Nos.
13	Thermistors	5 Nos.
14	OP-amp (IC741)	10 Nos.
15	Milli Ammeter (0-100mA)	15 Nos.
16	Micro Ammeter (0-50μA)	10 Nos.
17	Low range voltmeter (0-30V)	10 Nos.
18	Resistor of various ranges	50 Nos.
19	Capacitors of various ranges	50 Nos.
20	Connecting wires (Single Strand)	10 Coils
21	Multisim	25 Users

15UMA422	NUMERICAL METHODS (Common to EEE, CIVIL & CHEMICAL)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To acquaint the student with the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- To familiarize the student with the methods discussed on interpolation which will be useful in constructing approximate polynomial to represent the data and to find the intermediate values, when huge amounts of experimental data are involved.
- To make the student acquire sound knowledge in applications of numerical methods in various fields, solving practical technical problems using scientific and mathematical tools when available in Engineering.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9 + 6

Iteration method – Newton-Raphson method –Gauss Elimination method – Pivoting – Gauss Jordan methods –iterative methods : Gauss Jacobi method ,Gauss Seidel method - Eigenvalues of a matrix by Power method – Jacobi's method for a real symmetric matrix.

UNIT II INTERPOLATION AND APPROXIMATION 9 + 6

Lagrange's interpolation – Newton's divided difference interpolation – Newton's forward and backward difference interpolation –cubic spline.

UNIT III NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9 + 6

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two point and Three point Gaussian quadrature formulae - Double integrals using Trapezoidal and Simpson's rules.

UNIT IV NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 9 + 6

Single step methods: Taylor series method – Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and

Adam's predictor and corrector methods.

UNIT V NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 6

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL : 45 (L) + 30 (T) = 75 PERIODS

COURSE OUTCOMES:

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

- Determine the approximate solutions of algebraic and transcendental equations through Newtons, Iteration, Gauss seidel and Gauss Jacobbi methods. [Apply]
- Apply the Interpolation techniques for equal and unequal intervals to find the function f(x) for some interior values of x. [Apply]
- Solve single and double integrals using Numerical integration techniques. [Apply]
- Apply Rungekutta, Predictor and corrector methods for finding the approximate solutions of ordinary differential equations. [Apply]
- Apply computational methods for finding the approximate solutions of Partial differential equations. [Apply]

TEXT BOOKS:

1. Sastry S.S., "Introductory methods of Numerical Analysis", Prentice Hall of India, New Delhi, 4th Edition, (2008).
2. Srimantapal "Numerical methods Principles Analysis and Algorithm", Edition 2009, Oxford press,,New Delhi.

REFERENCE BOOKS:

1. Kandasamy.P, Thilagavathy.K and GUNAVATHY.K, "Numerical Methods", S.Chand Co. Ltd., New Delhi, (2003).
2. Gerald C.F. and Wheateley P.O., "Applied Numerical Analysis", Pearson Education, New Delhi, 6th Edition, (2006).
3. GrewaL B.S. and Grewal J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, (2007).

4. Chapra S. C and Canale R. P. “Numerical Methods for Engineers”, Tata McGraw-Hill, New Delhi, 5th Edition, (2007).
5. Sankar Rao.K, “Numerical Methods for scientists and engineers”, Prentice Hall of India, New Delhi,3rd Edition, (2007).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3			1								1	2	2
CO.2	3			1								1	2	2
CO.3	3			1								1	2	2
CO.4	3			1								1	2	2
CO.5	3			1								1	2	2

15UEE402	AC MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on theory and performance characteristics of Induction machines, Synchronous machines
- To familiarize the operation and performance characteristics of fractional horse power motors.

UNIT I THREE-PHASE INDUCTION MOTORS **9**

Construction details- Principle of operation – Types of rotors – Torque equation – Torque-Slip characteristics. Maximum torque – Effect of rotor resistance. Equivalent circuit -Phasor diagram – Performance calculation from circle diagram, Losses and Efficiency, Double cage rotor- induction generator- synchronous induction motor.

UNIT II THREE PHASE INDUCTION MOTOR STARTING & SPEED CONTROL METHODS **9**

Starters – DOL, Auto-Transformer, Star-Delta and Rotor resistance starters –Crawling and Cogging – Electrical Braking - Speed control by rotor resistance, Pole changing ,cascaded connection - change of supply voltage and frequency, injection of EMF in the rotor circuit, Slip power recovery Scheme.

UNIT III SYNCHRONOUS GENERATOR **9**

Types and construction – EMF equation –Armature reaction- Synchronous reactance and impedance- Voltage regulation by EMF, MMF, ZPF and ASA methods- Parallel operation- load characteristics, salient pole machine.- Blondel two reaction theory for salient pole machine - Slip test for the measurement of Xd and Xq - Phasor diagram using Xd, and Xq – Capability curves.

UNIT IV SYNCHRONOUS MOTOR **9**

Principle of operation – Torque Equation - Methods of starting –-Operation on infinite bus bar. Phasor diagrams – V-curves and Inverted V-curves – Current loci for constant power input, constant excitation and constant power developed— Hunting and methods of Suppression Synchronous condensers.

UNIT V SINGLE PHASE MOTORS 9

Principle of operation of single phase induction motor-Double field revolving field theory – Cross field theory, Equivalent circuit- Performance analysis – Starting method of single phase induction motor-split phase induction motor (resistance & capacitance type), shaded pole, repulsion, A.C. series, Universal motor– Reluctance motor – Hysteresis motor - Linear inductance motor

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze the performance characteristics of three phase induction machines for the selection of suitable applications. [Analyze]
- Select a suitable starter and speed control method for induction motor applications. [Analyze]
- Compute voltage regulation and efficiency of synchronous generator by using different methods. [Apply]
- Explain the operation of synchronous motor and its performance for various applications. [Apply]
- Explain the operation of single phase motors and select suitable motor for a given application. [Apply]

TEXT BOOKS:

1. Gupta J.B., “Theory and Performance of Electrical Machines”, S.K.Kataria and Sons, 2008.
2. Bhimbhra P.S., “Electrical Machinery”, Khanna Publishers, Eighth Edition, 2003.

REFERENCE BOOKS:

1. Fitzgerald A.E.,Charles Kingsley and Stephen D. Umans, “Electrical Machine Design Data Book”, 2003.
2. Say M.G., “ Alternating Current Machines”, Fifth Edition.1990.
3. Theraja B.L., “A Text Book of Electrical Technology”, S.Chand & Co. Ltd, 2007.
4. Murugesh Kumar K., “Electric Machines”, Vikas publishing house Pvt Ltd, 2002.
5. Mehta V.K., “Principles of Electrical Machines ”, S.Chand & Co. Ltd, 2007.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3				2							3	
CO.2	3	3				2							3	
CO.3	3												2	
CO.4	3					2							2	
CO.5	3					2							2	

15UEE403	CONTROL SYSTEMS	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state feedback

UNIT I SYSTEMS AND THEIR REPRESENTATION 9+6

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 9+6

Time response – Time domain specifications – Types of test input–I and II order system response –Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE 9+6

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Effect of Lag, lead and lag-lead compensation on frequency response- Analysis.

UNIT IV STABILITY AND COMPENSATOR DESIGN 9+6

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria –Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9+6

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability –Effect of state feedback.

TOTAL : 45 (L) + 30 (T) = 75 PERIODS

COURSE OUTCOMES:

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

- Develop mathematical model and compute transfer function using block diagram reduction and signal flow graph for physical systems [Apply]
- Analyze the time response of first and second order systems for identifying the system behaviour. [Analyze]
- Examine the frequency response of a given system using Bode plot and Polar plot. [Analyze]
- Examine the stability of the system and design suitable compensator for given frequency domain specifications. [Create]
- Develop state variable representation to identify the controllability and observability of given system. [Apply]

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', Fifth Edition,New Age International Publishers,2008.
2. Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.

REFERENCE BOOKS:

1. K. Ogata, 'Modern Control Engineering', 5th edition, Anshan Publishers, 2010.
2. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi, 2007.
3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004
4. M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, 2002.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2										2	2	2
CO.2	3	3			2							2	2	3
CO.3	3	3			2							2		
CO.4	3	3	3	2								3	2	3
CO.5	3	2										3		

15UEE404	TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To impart knowledge on the computation of transmission line parameters and modeling of transmission lines
- To understand the operation of the different distribution schemes.

UNIT I STRUCTURE OF POWER SYSTEM **9+6**

Structure of electric power system: generation, transmission and distribution; Types of AC and DC distributors – distributed and concentrated loads – interconnection – EHVAC and HVDC transmission -Introduction to FACTS.

UNIT II TRANSMISSION LINE PARAMETERS **9+6**

Parameters of single and three phase transmission lines with single and double circuits - Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects - interference with neighboring communication circuits - Typical configurations, conductor types and electrical parameters of EHV lines, corona discharges.

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES **9+6**

Classification of lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation, real and reactive power flow in lines, Power - circle diagrams, surge impedance loading, methods of voltage control; Ferranti effect.

UNIT IV INSULATORS AND CABLES **9+6**

Insulators - Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables - Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3- core belted cable, D.C cables.

UNIT V MECHANICAL DESIGN OF LINES AND GROUNDING **9+6**

Mechanical design of transmission line – sag and tension calculations for different weather conditions, Tower spotting, Types of towers, Substation Layout (AIS, GIS), Methods of grounding.

TOTAL: 45(L)+30 (T) =75 PERIODS

COURSE OUTCOMES:

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

- Explain the structure of power system and choose appropriate voltage level for generation, transmission and distribution. [Apply]
- Compute the transmission line parameters for electrical power system. [Apply]
- Compute the regulation and efficiency of different types of transmission lines. [Apply]
- Analyze the voltage distribution for the proper selection of insulator strings and cables. [Analyze]
- Determine the mechanical design parameters of lines and explain the substation layout and grounding methods. [Apply]

TEXT BOOKS:

1. Kothari D. and Nagarath I.J., “Power System Engineering”, Tata McGraw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. Wadhwa C.L., “Electrical Power Systems”, New Academic Science Ltd, 2009.
3. Singh S.N., “Electric Power Generation, Transmission and Distribution”, Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCE BOOKS:

1. Gupta B.R and Chand S., “Power System Analysis and Design”,New Delhi, Fifth Edition, 2008.
2. Luces M. Fualkenberry and Walter Coffer, “Electrical Power Distribution and Transmission”, Pearson Education, 2007.
3. Hadi Saadat, “Power System Analysis”, PSA Publishing; Third Edition, 2010.
4. Brian J., Hardy and Colin R.Bayliss , “Transmission and Distribution in Electrical Engineering”,Newnes; Fourth Edition, 2012.
5.Ramamurthy G., “Handbook of Electrical power Distribution” , Universities Press, 2013

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3					2								
CO.2	3	2												
CO.3	3	2				2								
CO.4	3	3										2		
CO.5	3	2				3		3				2		

15UEE405	ANALOG INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the characteristics of OPAMP and IC fabrication procedure
- To introduce the design of OPAMP based application circuits.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realization of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

UNIT I CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: Voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, Log and antilog amplifiers, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types

UNIT IV SPECIAL ICs 9

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications, Analog multiplier ICs.

UNIT V APPLICATION ICs 9

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, IC L8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Outline the fabrication procedure of Integrated circuits (IC) for electronic components. [Understand]
- Analyze the characteristics of op-amp and select suitable op-amp circuit for the given application. [Analyze]
- Construct the circuits for linear and nonlinear applications using operational amplifier. [Apply]
- Design a circuit for the given application using IC555/566/565. [Create]
  Explain the operation of regulator circuits, power amplifier and function generator. [Understand]

TEXT BOOKS:

1. Ramakant A.Gayakward, "Op-amps and Linear Integrated Circuits", Pearson Education, Fourth Edition, 2003.
2. Roy Choudhary D. and Sheil B. Jani, "Linear Integrated Circuits", New Age, Fourth Edition, 2011.

REFERENCE BOOKS:

1. Jacob Millman. and Christos C. Halkias, " Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill,2003.
2. Robert F. Coughlin and Fredrick F. Driscoll, "Op-amp and Linear ICs", Pearson Education Fifth Edition., 2002.
3. David A. Bell, "Op-amp & Linear ICs", Prentice Hall of India, 1997.
4. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Tata McGraw –Hill, second Edition, 2002.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3													
CO.2	3	3												
CO.3	3											2		
CO.4	3	3	3	2					2			2		3
CO.5	2													2

15UEE406	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the general instrument system, error, calibration etc.
- To familiarize the comparison methods of measurement.
- To explain storage and display devices, various transducers and data acquisition system

UNIT I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and types of analog and digital voltmeters, ammeters, multimeters – Single and three phase Watt meters and energy meters, Trivector meter - Maximum Demand Indicator – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase, Power factor meter.

UNIT III COMPARISON METHODS OF MEASUREMENTS 9

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, Storage CRO - Multiple trace digital CRO- dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezo electric ,Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply the norms and standards for the calibration of measuring instruments. [Apply]
- Illustrate the working principle of various electrical and electronics instruments for the measurement of electrical quantity. [Understand]
- Compute the unknown values using DC & AC potentiometers and bridges. [Apply]
- Summarize the operation of various storage and display devices. [Understand]
- Select a suitable transducer for a given application and also explain the components of data acquisition system. [Apply]

TEXT BOOKS:

1. Doebelin E.O, "Measurement Systems – Application and Design", Tata McGraw Hill publishing company, 2003 .
2. Sawhney A.K. , "A Course in Electrical & Electronic Measurements & Instrumentation ", Dhanpat Rai and Co, 2004

REFERENCE BOOKS:

1. Bouwens A.J., " Digital Instrumentation ", Tata McGraw Hill, 1997
2. Moorthy D.V.S., "Transducers and Instrumentation ", Prentice Hall of India Pvt Ltd, 2007
3. Kalsi H.S., " Electronic Instrumentation ", Tata McGraw Hill, II Edition, 2004
4. Martin Reissland., "Electrical Measurements", New Age International (P) Ltd, 2001.
5. Gupta J. B., "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, 2003.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2				3		3						
CO.2	2					2						1		
CO.3	3	2												
CO.4	2											2		
CO.5	3					2						2		2

15UGS431	REASONING AND QUANTITATIVE APTITUDE (Common to ALL Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To make the student acquire sound knowledge of the characteristic of quantitative and qualitative aptitude.
- To familiarize the student with various principles involved in solving mathematical problems.
- To develop an understanding of the basic concepts of reasoning skills.

UNIT I QUANTITATIVE APTITUDE 8

Numbers – HCF and LCM - Arithmetic and Geometric Progression – Averages –Percentages – Problems on ages – Profit and Loss – Simple and Compound Interest - Ratio and Proportion – Time – Speed –Distance- Work – Pipes and Cistern – Problems on Trains – Permutation and Combination – Clocks – Calendars.

UNIT II VERBAL AND NON VERBAL REASNING 7

Analytical Reasoning – Circular and Linear arrangement – Direction problems – Blood relations – Analogy – Odd Man Out – Venn Diagrams – Statement and Conclusion, Statement and Implications – Letter series & arrangement – Alpha Numeric Series – Syllogism - Coding – Decoding.

TOTAL = 15 Periods

COURSE OUTCOMES:

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

- Solve the problems on commercial mathematics and correlation. [Apply]
- Interpret graphical and numerical data. [Apply]

WEBSITES:

www.tcyonline.com , www.m4maths.com, www.indiabix.com , www.fresherworld.com, www.careerbless.com

TEXT BOOKS:

1. Dr. R.S.Agarwal, "Quantitative Aptitude", S. Chand Publications, New Delhi, 17th Edition, (2010).
2. TRISHNA KNOWLEDGE SYSTEMS, "Quantitative Aptitude", Pearson Education, South Asia, 2nd Edition, (2009).

REFERENCE BOOKS:

1. Abijit Guha, "Quantitative Aptitude for Competitive Examinations", Tata McGraw Hill Publication, New Delhi, 4th Edition, (2011).
2. Dr. V.A.Sathgurunath'S "A Guide for Campus Recruitment", Sagarikka Publications, Thiruchirapalli, 3rd Edition, (2011).
3. Nishit K.Sinha "Quantitative Aptitude for CAT", Pearson Publication, New Delhi, 2nd Edition, (2009).
4. Dr. N.K.Singh, "Quantitative Aptitude Test", Upkars Prakashan Publications, Agra, Revised Edition, (2013).

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3										2	2		
CO.2	3										2	2		

15UEE408	AC MACHINES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To demonstrate the performance characteristics of Synchronous machines, Induction machines and Alternators

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by emf and mmf methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Load test on three phase alternator.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor.
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Measurements of negative sequence and zero sequence impedance of alternators.

A minimum of TEN experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Determine voltage regulation of three phase alternator by various methods. [Evaluate]
- Analyze the characteristics curves of synchronous and induction motors and selects suitable motor for various applications. [Analyze]
- Calculate the efficiency and equivalent circuit parameters of Induction Motor by indirect method. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3				2		3	3	2			3	
CO.2	3	3				2		3	3	2			3	
CO.3	3	2				2		3	3	2			3	

HARDWARE REQUIREMENT

S.No.	Description of Equipment	Quantity Required
1.	DC shunt motor coupled three phase alternator	4
2.	Synchronous motor	1
3.	Three phase induction motors	
	Squirrel cage	2
	Slip ring	1
4.	DC Shunt motor coupled salient pole three phase alternator	1
5.	Single phase induction motors	2
6.	Air core inductor to do ZPF	1
7.	Starter-	
	Three phase induction motor starters	1
	Single phase induction motor starters	1
8.	Meters-	
	Voltmeter (MI)	15
	Ammeter (MI)	15
	Wattmeter (LPF)	15
	Wattmeter (UPF)	30
9	Double element wattmeters of different ranges	4
10	Three phase auto transformer	5
11.	Rheostats of various range	12
12.	Power factor meter	2
13.	Inductive load	1

15UEE409	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To impart knowledge on analysis and design of control system along with basics of instrumentation

LIST OF EXPERIMENTS:

CONTROLSYSTEMS:

1. Determination of transfer function parameters of Armature controlled and Field controlled of DC (Servo) motor.
2. Determination of transfer function parameters of an AC servomotor.
3. Analog simulation of type-0 and type-1 systems
4. Digital simulation of first order and second order systems
5. DC and AC position control systems.
6. Stepper motor control system
7. Determination of transfer function parameters of DC generators.
8. Design of P, PI and PID controllers.

A minimum of FIVE experiments shall be offered

INSTRUMENTATION:

1. AC bridges.
2. DC bridges.
3. Instrumentation amplifiers.
4. A/D and D/A converters.
5. Measurement of iron loss.
6. Measurement of complex power with Trivector meter and verification

A minimum of FIVE experiments shall be offered

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CONTROLSYSTEMS:

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

- Determine the transfer function parameters of DC & AC servomotors and DC generator. [Apply]
- Analyze the transient response of type-0, type-1, first and second order systems for identifying the system behavior. [Analyze]
- Examine the performance of different position control systems. [Apply]

INSTRUMENTATION:

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

- Compute the unknown values of R, L and C by using a suitable bridge circuit. [Apply]
- Compute iron loss using ring specimen and complex power using trivector meter. [Apply]
- Construct and test the working of instrumentation amplifier, A/D and D/A converters. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3			3			3	3	2				
CO.2	3	2						3	3	2				
CO.3	3	2						3	3	2				
CO.4	3	2						3	3	2				
CO.5	3	2						3	3	2		2		2
CO.6	3	3			3			3	3	2				

HARDWARE REQUIREMENT:

CONTROLSYSTEMS:

Sl.No	Description of Equipment	Quantity required
1.	DC Servo motor Field separately excited-loading facility variable voltage source	1
2.	AC servo Motor Minimum of 100w necessary sources for main winding & control winding	1
3.	Rigged up models of type-o & type-1 system using analog components	1
4.	System with MATLAB / MATHCAD (or) equivalent software (or) SCILAB	minimum 3 user license
5.	AC position control kit	1
6.	DC position control kit	1
7.	Stepper Motor	1
	Microprocessor kit	1
8.	DC Generator	1
	Tachometer	1
	Various meters	1 Each
	Stop watch	1
9.	PID controller trainer kit	1

INSTRUMENTATION:

Sl.No	Description of Equipment	Quantity required
1	**AC bridge**	
	a) Maxwell's Inductance – Capacitance Bridge	
	1. Maxwell's inductance Capacitance Bridge kit	1 No.
	2. Multimeter	1 No.
	3. Unknown Inductance	1 No.
	b) SCHERING BRIDGE	
	1. Schering Bridge kit	1 No.
	2. Multimeter	1 No.
	3. Unknown capacitance	1 No.
2.	**DC bridges**.	
	a) Wheat Stone Bridge	
	1. Wheat stone Bridge kit	1 No.
	2. Unknown resistance	1 No.
	3. Multimeter	1 No.
	b) KELVIN'S DOUBLE BRIDGE	
	1. Kelvin Double bridge kit	1 No.
	2. Unknown resistance	1 No.
	3. Multimeter	1 No.
3	**Instrumentation amplifiers**	
	1. Operational Amplifier	1 No.
	2. Resistors	1 No.
	3. RPS	1 No.
	4. Voltmeter	1 No.
	5. Multimeter	1 No.

4	**A/D and D/A converters**	
	a) A/D converters	
	1. IC 741	1 No.
	2. DC trainer kit	1 No.
	3. RPS	1 No.
	4. Resistor	1 No.
	5. CRO	1 No.
	b) D/A converters	
	1. IC 741	1 No.
	2. DC Trainer kit	1 No.
	3. RPS	1 No.
	4. Resistor	1 No.
	5. CRO	1 No.
5	**Measurement of iron loss (Maxwell Bridge)**	
	1. Maxwell bridge set up	1 No.
	2. Ring specimen	1 No.
	3. Ammeter	1 No.
	4. Galvanometer	1 No.

15UEE410	DIGITAL AND ANALOG INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

To inculcate the knowledge on design, testing and characterizing of circuit behavior using digital and analog ICs

LIST OF EXPERIMENTS

1. Study of Basic Digital IC's. (Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF, D FF)
2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
3. (a) Code converters, Parity generator and parity checking, Excess-3, 2s Complement, Binary to Gray code using suitable IC's .
   (b) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
4. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
5. Shift Registers:
   Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's. Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer
6. Timer IC application:
   NE/SE 555 timer in Astable, Monostable operation.
7. Application of Op-Amp:
   Slew rate verifications, inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
8. Study of Comparator with Hysteresis
9. Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.
10. Study of VCO and PLL ICs:
    i. Voltage to frequency characteristics of NE/ SE 566 IC.
    ii. Frequency multiplication using NE/SE 565 PLL IC.

A minimum of TEN experiments shall be offered

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

- Design and implement combinational circuits using logic gates. [Apply]
- Design and implement counters and shift registers. [Apply]
- Design multivibrator using 555 timer. [Apply]
- Design analog computational circuits using IC741. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2	2						3	2		2		2
CO.2	3								3	2		2		2
CO.3	3	2	2						3	2		2		2
CO.4	3	2	2						3	2		2		2

HARDWARE REQUIRMENTS:

S.No.	Description of Equipment	Quantity Required
1	Dual Regulated Power Supply Single Regulated Power Supply	4 each
2	CRO and Function Generator	3 each
3	Digital IC trainer Kit	15
4	Analog IC trainer kit	4
5	Components and bread boards	10 each
6	Chips IC – 7400	10
7	Chips IC – 7402	10

8	Chips IC – 7408	10
9	Chips IC – 7432	10
10	Chips IC – 7410	25
11	Chips IC – 555, IC-566, IC-565	Each 10
12	Chips IC – 741	10
13	Chips IC – 74153	10
14	Chips IC – 7474	10
15	Chips IC – 7490	10
16	Chips IC – 7447	10

15UEE501 **POWER ELECTRONICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.
- To get an overview of different types of power semiconductor devices and their dynamic characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations of AC voltage controller.

UNIT I SWITCHING POWER SUPPLIES 9

SCR and MOSFET dynamic behaviour - driver and snubber circuits - low power high switching frequency switching Power supplies, buck, boost, buck-boost converters – Isolated topologies (Fly back converter) – Introduction to resonant converters - switching loss calculations and thermal design.

UNIT II INVERTERS 9

IGBT : Static dynamic behaviour - single phase half bridge and full bridge inverters - SCR based : six step three phase VSI, ASCI - PWM (both unipolar and Bipolar) – third harmonic injected sine PWM - space vector PWM – selective harmonic elimination.

UNIT III UNCONTROLLED RECTIFIERS 9

Power Diode – half wave rectifier – mid-point secondary transformer based full wave rectifier – bridge rectifier – voltage doubler circuit – distortion factor – capacitor filter for low power rectifiers – LC filters –three phase diode bridge.

UNIT IV CONTROLLED RECTIFIERS 9

Two transistor analogy based turn- ON – turn ON losses – thermal protection – controlled converters (1 pulse, 2 pulse, 3 pulse, 6 pulse) - displacement factor – ripple and harmonic

factor - power factor mitigation, performance parameters – effect of source inductance - inverter angle limit.

UNIT V AC PHASE CONTROLLERS 9

TRIAC triggering concept with positive and negative gate pulse triggering, TRIAC based phase controllers - various configurations for SCR based single and three phase controllers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply the knowledge of SCR and MOSFET for the design of switching power supplies. [Apply]
- Analyze the operation of inverter topologies and select a suitable PWM techniques for voltage and harmonic control. [Analyze]
- Analyze the performance of uncontrolled rectifiers for various applications. [Analyze]
- Analyze the performance of controlled rectifiers for various applications. [Analyze]
- Analyze the performance of AC voltage controllers with SCR and TRIAC for voltage regulation. [Analyze]

TEXT BOOKS:

1. Ned Mohan, T.M.Undeland, W.P.Robbins, ”Power Electronics: Converters, applications and design”, John Wiley and Sons, 3rd Edition (reprint), 2009.
2. Rashid M.H, “Power Electronics: Circuits, Devices and Applications ”, Pearson Education, PHI Third edition, 2009.
3. Singh M.D, “Power Electronics”, Tata McGraw-Hill Education, Second Edition, 2008

REFERENCE BOOKS:

1. Cyril.W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2012.
3. PhilipT.Krein, Elements of Power Electronics, Oxford University Press, 2013.
4. P.C.Sen, Power Electronics, Tata McGraw-Hill, 30th reprint, 2008.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2										3		2
CO.2	3	3	2	2								3		3
CO.3	3	3										3		3
CO.4	3	3	2	2	3				2			3		3
CO.5	3	3			3				2			3		3

15UEE502	POWER SYSTEM ANALYSIS	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To familiarize with solving of power flow problems using efficient numerical methods suitable for computer simulation.
- To discuss about the power systems under abnormal conditions for both balanced and unbalanced load
- To impart knowledge on stability analysis of power system

UNIT I INTRODUCTION 9+6

Modern power system (or) electric energy system - Analysis for system planning and operational studies – basic components of a power system. Generator models - transformer model – transmission system model - load representation. Single line diagram – per phase and per unit representation – change of base. Simple building algorithms for the formation of Y-Bus matrix and Z-Bus matrix

UNIT II POWER FLOW ANALYSIS 9+6

Importance of power flow analysis in planning and operation of power systems. Statement of power flow problem - classification of buses - Development of Power flow model in complex variables form. Iterative solution using Gauss-Seidel method - Newton-Raphson (-N-R) method (polar form) - Fast Decoupled Power Flow (FDPF)- Comparison of all the methods- model and iterative solution – algorithm and flowchart- DC - AC power flow

UNIT III FAULT ANALYSIS – BALANCED FAULTS 9+6

Importance short circuit (or) for fault analysis - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS 9+6

Introduction to symmetrical components – sequence impedances – sequence networks – representation of single line to ground, line to line and double line to ground fault conditions.

Unbalanced fault analysis - problem formulation – analysis using Z-bus impedance matrix – (algorithm and flow chart.).

UNIT V STABILITY ANALYSIS 9+6

Importance of stability analysis in power system planning and operation - classification of power system stability - angle and voltage stability –Single Machine Infinite Bus (SMIB) system: Development of swing equation (Transient and steady state)- step by step method, modified Euler method and Runge-Kutta second order method. Algorithm and flow chart-equal area criterion - determination of critical clearing angle and time

TOTAL: 45(L)+30 (T) =75 PERIODS

COURSE OUTCOMES:

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

- Develop single line diagram of given power system and Form Bus admittance and Bus impedance matrix. [Apply]
- Solve power flow problem using Gauss-Seidal, Newton Raphson and Fast Decoupled load flow methods. [Apply]
- Analyze the power system under symmetrical fault condition for the design of protective devices. [Analyze]
- Analyze the power system under unsymmetrical fault condition for the design of protective devices. [Analyze]
- Analyze the stability of the power system during steady and transient operations for power system planning and operation. [Analyze]

TEXT BOOKS:

1. Nagrath I.J. Kothari D.P, “Modern Power System Analysis”, Tata McGraw-Hill, Forth Edition, 2011 .
2. John J.Grainger and W.D.Stevenson Jr., “Power System Analysis”, Tata McGraw-Hill, Sixth reprint, 2010.

REFERENCE BOOKS:

1. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
2. Kundur P. , “Power System Stability and Control”, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Olle. I. Elgerd, “ Electric Energy Systems Theory – An Introduction ”, Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2012.
4. P.Venkatesh, B.V.Manikandan, S.Charles Raja, A.Srinivasan, “Electrical Power Systems Analysis, Security and Deregulation”, PHI Learning Private Limited, New Delhi, 2012.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2			2							2		
CO.2	3	3	2	2	2	2						3		
CO.3	3	3	2	2	2	2						2		
CO.4	3	3	2	2	3							2	2	
CO.5	3	2			2							2		

15UEE503	MICROPROCESSORS AND MICROCONTROLLER PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize the architecture, addressing modes and instruction sets of µP8085 & µC 8051
- To inculcate knowledge on programming using 8085 & 8051and interfacing

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pin outs – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pin outs – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts-Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING 9

Introduction-Generation of I/O Ports, Programmable Peripheral Interface (PPI)-Intel 8255, Synchronous and asynchronous communication – Programmable communication Interface (8251), DMA Controller – Organization of Intel 8237 , Interfacing and Programmable interval timer 8254 – Operating modes –Interrupt Controller - Organization of programmable interrupt controller 8259, Sample-and-Hold Circuit and Multiplexer, Keyboard and Display Interface - Keyboard and Display Controller (8279), D-to-A converter, A-to-D converter.

UNIT V MICRO CONTROLLER PROGRAMMING AND APPLICATIONS 9

Data Transfer, Manipulation, Control Algorithms & I/O instructions – Simple programming exercises key board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Illustrate the architecture and timing diagram of 8085 microprocessor. [Understand]
- Develop an assembly language program using the instruction set of 8085 for arithmetic and logical operations. [Apply]
- Describe the architecture of 8051 and also compare with 8085. [Understand]
- Select a suitable IC for peripheral interfacing with 8085 for a given application. [Apply]
  Develop an assembly language program for microcontroller based applications. [Apply]

TEXT BOOKS:

1. Krishna Kant, “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.
2. Muhammad Ali Mazidi , Janice Gilli Mazidi and R.D.Kinel, “The 8051 Micro Controller and Embedded Systems”, PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCE BOOKS:

1. Gaonkar R.S., “Microprocessor Architecture Programming and Application”, with 8085, Wiley Eastern Ltd., New Delhi, 2013.
2. Soumitra Kumar Mandal, “Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051”, McGraw Hill Edu,2013.
3. Senthil Kumar N., Saravanan M., Jeevananthan S., “Microprocessors and Microcontrollers”, Oxford,2013.
4. Godse A.P., Godse G.P,“Microprocessors &Microcontrollers ”, Technical Publication, 2010.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2													
CO.2	3	2												
CO.3	2													
CO.4	3	2	2									3		2
CO.5	3	2	2									2		2

15UEE504	ELECTRICAL MACHINE DESIGN	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To impart knowledge on the design of DC &AC machines
- To introduce the basic design concepts and cooling arrangement of transformer

UNIT I INTRODUCTION 9+6

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 – Standard specifications.

UNIT II DC MACHINES 9+6

Output Equations – Main Dimensions -Magnetic circuit calculations – Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Unbalanced Magnetic Pull- Selection of number of poles – Design of Armature – Design of Field winding - Design of commutator and brushes – performance prediction using design values.

UNIT III TRANSFORMERS 9+6

Output Equations – 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 Tank - Methods of cooling of Transformers.

UNIT IV INDUCTION MOTORS 9+6

Output equation of 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 –Operating characteristics.

UNIT V SYNCHRONOUS MACHINES 9+6

Output equations – choice of loadings – 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.

TOTAL: 45(L)+30 (T) =75 PERIODS

COURSE OUTCOMES:

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

- Apply the knowledge of electrical & thermal considerations and standards for the design of electrical machines. [Apply]
- Design a DC machine for the given specifications. [Create]
- Estimate main dimensions and cooling tube arrangement for the design of transformers. [Evaluate]
- Design a Induction machine for the given specifications. [Create]
- Design a Synchronous machine for the given specifications. [Create]

TEXT BOOKS:

1. Sawhney A.K, "A Course in Electrical Machine Design ", Dhanpat Rai& Sons, Sixth edition 2010.
2. Sen S.K., " Principles of Electrical Machine Designs with Computer Programmers ", Oxford and IBH Publishing Co. Pvt. Ltd, 2006.

REFERENCE BOOKS:

1. Shanmugasundaram A., Gangadharan and Palani R, "Electrical Machine Design Data Book ", New Age International Pvt. Ltd., 2007.
2. Upadhyay K.G., " Design of Electrical Machines", New Age International Pvt. Ltd., 2008
3. Agarwal R.K., "Principles of Electrical Machine Design ", S.K.Kayaria& Sons , 2007
4. Eclayton A. and NNHancock, , "The performance and Design of Direct current Machines ", CBS & Distributors Pvt.Ltd, 2004.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2						3				3	2	
CO.2	3	3	3		3			3				3	3	
CO.3	3	3	3		3			3				3	3	
CO.4	3	3	3		3			3				3	3	
CO.5	3	3	3		3			3				3	3	

15UEE507	POWER ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To demonstrate the performance and characteristics of power semiconductor devices, converters and inverters

LIST OF EXPERIMENTS

1. Characteristics of SCR
2. Characteristics of DIAC and TRIAC
3. Characteristics of MOSFET and IGBT
4. Transient characteristics of SCR and MOSFET
5. AC to DC fully controlled converter
6. AC to DC half-controlled converter
7. Step down and step up MOSFET based choppers
8. IGBT based single-phase PWM inverter
9. IGBT based three-phase PWM inverter
10. Resonant dc-to-dc converter
11. THD analysis in Multilevel Inverter
12. Simulation of Power electronic circuits using MATLAB
13. Study of battery charger, UPS and SMPS.

A minimum of TEN experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to:

- Select a suitable switching device for a given power electronic circuit. [Apply]
- Examine the performance of half and fully controlled converters for different loads. [Analyze]
- Examine the performance of chopper and inverter circuits for different loads. [Analyze]
- Design power electronic circuits using MATLAB - Simulink. [Analyze]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2						3	3	2				2
CO.2	3	3			3			3	3	2		2		3
CO.3	3	3			3			3	3	2		2		3
CO.4	3	3	3		3			3	3	2		2		3

HARDWARE REQUIREMENT:

S.No.	Description of Equipment	Quantity Required
1.	Device characteristics (for SCR, MOSFET, TRIAC and IGBT) kit with built in power supply & meters	2 each
2.	SCR firing circuit module	2 Nos.
3.	Single phase SCR based ½ controlled converter & fully controlled converter along with built-in / separate / firing circuit / module and meter	2 each
4.	MOSFET based step up and step down choppers	1 each
5.	IGBT based single phase PWM inverter module	2 Nos.
6.	IGBT based three phase PWM inverter module	2 Nos.
7.	IGBT based high switching frequency chopper module with built-in controller	2 Nos.
8.	Resonant DC-DC converter module with built in power supply and controller	2 Nos.
9.	SCR & TRIAC based 1 phase A.C.phase controller along with lamp or rheostat load	4
10.	SCR based V/I commuted chopper module with relevant firing module(separate or built-in)	4

11.	Dual regulated DC power supply with common ground	4
12.	Cathode Ray Oscilloscope	5
13.	Isolation Transformer	5
14.	Single phase Auto transformer	3
15.	Components (Inductance, Capacitance)	3 sets for each
16.	Multi meter	5
17.	LCR meter	3
18.	Rheostats of various ranges	2 sets of 10 value
19.	Work tables	12
20.	DC and AC metes of required ranges	20

15UEE508	MICROPROCESSORS AND MICROCONTROLLER PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To familiarize with programming of microprocessors and microcontrollers and the interfacing requirements

LIST OF EXPERIMENTS:

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
   - Ascending / Descending order, Maximum / Minimum of numbers
   - Programs using Rotate instructions
   - Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085
   A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
   - Conditional jumps, looping
   - Calling subroutines.
9.. Programming I/O Port 8051
   - Study on interface with A/D & D/A
   - Study on interface with DC & AC motor.
10. Mini project development with processors.

A minimum of TEN experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Write an assembly language program for arithmetic operations and data manipulation using 8085. [Apply]
- Develop an assembly language program to interface A/D, D/A converters and traffic light controller with 8085. [Apply]
- Write an assembly language program for arithmetic operations and data manipulation using 8085 simulator/open source software. [Apply]
- Develop an assembly language program for real time applications using 8051. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2						3	3	2				
CO.2	3	2	2					3	3	2		2		2
CO.3	3	2			3			3	3	2				
CO.4	3	2	2					3	3	2		2		
CO.5	3	2						3	3	2				

HARDWARE REQUIREMENT:

Sl. No.	Description of Equipment	Quantity required
1	8085 Microprocessor Trainer with Power supply	15
2	8051 Micro controller Trainer Kit with power supply	15

3	8255 Interface board	5
4	8251 Interface board	5
5	8259 Interface board	5
6	8279 Keyboard/Display Interface Board	5
7	8254 timer counter	5
8	ADC and DAC card	5
9	AC & DC Motor with controller	1 each
10	Traffic Light Control System	5

15UEE509	ELECTRICAL MACHINE DESIGN SIMULATION	L	T	P	C
	LABORATORY	0	0	2	1

OBJECTIVE:

- To impart knowledge on Electrcal Machine design software(ANSYS)

LIST OF EXPERIMENTS

1. Analyse the performance of 3φ, 6 poles, 50 hz squirrel cage induction motor by using ansys –maxwell 15 - RMXPRT software.
2. Analyse the performance of 3φ, 6 poles, 50 hz squirrel cage induction motor by using ansys –maxwell 15- Rmxprt software.
3. Analyse the Performance Of 4 Poles, 24 Slots Brushless Permanent Magnet Dc Motor Using Ansys –Maxwell 15- Rmxprt Software
4. Analyse the Performance Of 120 Volts, 2 Poles,12400 Rpm Universal Motor Using Ansys –Maxwell 15- Rmxprt Software
5. Analyse the Performance Of 4 Poles, 24 Slots, 1500rpm, Line Start Permanent Synchronous Motor Using ANSYS –Maxwell 15- Rmxprt Software
6. Analyse the Performance Of A Converter Based Push Pull Transformer Using Ansys Pexprt Software.
7. Analyse the Performance Of Three Level Inverter With Rl Load Using Ansys Simplorer -10 Soft Ware.
8. Analyse six- Pulse Thyristor Bridge With Dc Drive Using ANSYS Simplorer -10 Software.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to:

- Analyze the parameter permutations for the design of electric motors using ANSYS. [Analyze]
- Analyze the parameter permutations for the design of converter based push pull transformer using ANSYS. [Analyze]
- Analyze the performance for the design of electric drives using ANSYS. [Analyze]

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE:

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS.

SOFTWARE: ANSYS

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3	3	3	3			3	2	2			3	
CO.2	3	3	3	3	3			3	2	2			3	
CO.3	3	3	3	3	3			3	2	2			3	

15UGS531	SOFT SKILLS AND COMMUNICATION LABORATORY (Common to CSE, ECE, EEE & IT Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop a requisite knowledge in communication skills and soft skills .
- To enhance the students' acumen in sharpening the skills to meet the global challenges and industrial needs.

UNIT I **6**

Communication – Types of communication – Communication network – Communication Techniques- Barriers of Communication.

UNIT II **6**

Listening – Types of listening – Listening & Note Talking – Listening strategies – Barriers of Listening – Conversation & Oral skills – Improving fluency & self expression- Good Pronunciation.

UNIT III **6**

Reading comprehension – Enriching Vocabulary (restricted to 1000 words) – Error analysis – Visual perception – Transcoding – Formal and Informal letters – Resume writing – Report writing.

UNIT III **6**

Attitude – Self Confidence – Leadership Qualities – Effective Time Management – Surviving stress (Emotional Intelligence) – Overcoming failure- Professional Ethics – Interpersonal Skills.

UNIT IV **6**

Body Language – Types of Interview: Online interview, Mock Interview, Telephonic interview – GD - Presentation.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Present ideas and in a flexible manner and differentiate & eliminate the ambiguity. [Apply]
- Write well-structured and easily readable reports, e-mails and articles on complex topics in an appropriate style. [Understand]
- Comprehend any address in English face to face and through different media like telephone and public announcement. [Analyze]

LAB MANUAL:

To be compiled by the Department

REFERENCE BOOKS:

1. Allan Pease, Body Language, New Delhi, Sudha Publications (P) Ltd, 2005
2. Dr.Rathan Reddy, Team Development & Leadership, Mumbai, Jaico Publishing House, 2006
3. Chand.S, Soft Skills, New Delhi, S.Chand& Company Ltd, 2011.
4. Career Press Editors, 101 Great Resumes, Mumbai, Jaico Publishing House, 2006

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1									3	3				
CO.2										2				
CO.3										3				

15UEE601	ADVANCED ELECTRIC DRIVES AND CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To explain the operation of the converter / chopper fed dc drive and ac drive
- To impart knowledge on design of current and speed controllers for a closed loop solid state dc motor drive

UNIT I DRIVE CHARACTERISTICS CONVERTER / CHOPPER FED DC MOTOR DRIVE **10**

Introduction to electric drives – Equations governing motor load dynamics – steady state stability – multi quadrant operation - Classes of duty and Ratings-Drive Characteristics and selection of drives - Dynamics: about drive characteristics -Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive - Continuous and discontinuous conduction Time ratio and current limit control – 4 quadrant operation of converter, Microcontroller based control of DC motor drives.

UNIT II INDUCTION MOTOR DRIVES **10**

Stator voltage control – energy efficient drive - v/f control, constant air-gap flux – field weakening mode - voltage/current fed inverters - Block diagram of vector control - closed loop control - Microcontroller based control of Induction motor drives.

UNIT III DESIGN OF CONTROLLERS FOR DRIVES **10**

Transfer function for DC motor, load and converter – Closed loop control with current and speed feedback - Armature voltage control and field weakening mode control, Design of controllers: Current controller and speed controller - Converter selection and characteristics - Use of simulation software package.

LAB EXPERIMENTS

1. Simulation of Single Phase Fully Controlled Converter fed DC motor Drive
2. IGBT Chopper Fed DC motor Drive
3. IGBT based Three phase PWM Inverter Fed AC motor Drive
4. Simulation of Three Phase Fully Controlled Converter fed DC motor Drive
5. Simulation of speed of converter/chopper fed DC motor drive
6. Simulation of speed control of VSI fed three-phase induction motor.
7. Micro controller based speed control of Stepper motor.
8. Simulation of speed control of DC motor.

9. Modeling and simulation of Induction Motor using MATLAB
10. Simulation of Single phase AC Voltage Controller fed AC motor drive.

TOTAL :30(L)+30 (P)=60 PERIODS

COURSE OUTCOMES:

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

- Analyze the performance of converter fed dc drives for industrial applications. [Analyze]
- Analyze the performance of AC motor drives for industrial applications. [Analyze]
- Design closed loop controllers for solid state drives. [Analyze]
- Simulate and examine the performance of converter fed DC Drives. [Analyze]
- Simulate and examine the performance of converter fed AC Drives. [Analyze]

TEXT BOOKS:

1. Gopal K.Dubey, “Power Semi conductor controlled drives ”, New Jersey, 1989.
2. Bimal K. Bose, “ Modern Power Electronics and AC Drives ”, PHI / Pearson Education, Eighth Edition, 2002.

REFERENCE BOOKS:

1. De N.K. and Sen S.K, “Electrical Drives”, PHI, 9th Edition, 2009.
2. Vedam Subramanyam, “ Electric Drives: Concepts and Applications” ,Tata McGraw Hill Ltd, 2004
3. Krishnan R, “ Electric Motor & Drives Modeling, Analysis and Control ”, Prentice Hall of India,2001
4. Eclayton A. and NNHancock,, “The performance and Design of Direct current Machines”,CBS & Distributors Pvt.Ltd, 2004.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3											2	3
CO.2	3	3											2	3
CO.3	3	3	2		3								2	3
CO.4	3	3			3				2	2			2	2
CO.5	3	3			3				2	2			2	2

15UEE602	PROTECTION AND SWITCH GEAR	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the characteristics and functions of relays and protection schemes
- To impart knowledge on apparatus protection and functioning of circuit breakers
- To introduce static and numerical relays

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Methods of Neutral grounding – Zones of protection and essential qualities of protection – Protection schemes

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes -Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators– Block diagram of Numerical relays – Over current protection, transformer differential protection and distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping -interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Select an appropriate protective scheme against various types of faults for power system protection. [Apply]
- Choose a suitable electromagnetic relay for power system protection [Apply]
- Select a suitable protective scheme for electrical apparatus. [Apply]
- Choose a suitable static and numerical relays for power system protection. [Apply]
- Select a suitable Circuit breaker for the given condition. [Apply]

TEXT BOOKS:

1. Sunil S.Rao, "Switch gear and Protection", Khanna Publishers, New Delhi, 2008.
2. Rabindranath B. and Chander N., "Power System Protection and Switchgear", New Age International (P) Ltd., First Edition 2011.
3. Soni M.L., Gupta P.V., Bhatnagar U.S. and Chakrabarti A., "A Text Book on Power System Engineering", Dhanpat Rai& Co.,1998.

REFERENCE BOOKS:

1. BadriRam B.H. Vishwakarma, "Power System Protection and Switchgear", New Age International Pvt Ltd Publishers, Second Edition, 2011.
2. Paithankar Y.G. and Bhide S.R., "Fundamentals of power system protection", Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. Wadhwa C.L., "Electrical Power Systems", 6th Edition, New Age International (P) Ltd., 2010
4. Ravindra P.Singh, "Switchgear and Power System Protection", PHI Learning Private Ltd., NewDelhi, 2009.
5. BhaveshBhalja, Maheshwari R.P. and Nilesh G. Chotani, "Protection and Switchgear", Oxford University Press, 2011.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3					3								
CO.2	3					3								
CO.3	3	2				3		2				1		
CO.4	3					3						2		
CO.5	3	2				3		2				1		

15UEC621	SIGNAL PROCESSING (Common to EEE & EIE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concept of signals and systems
- To explain the different transform techniques to analyze the discrete time systems
- To provide a thorough understanding of the design techniques for digital filters and digital signal processors

UNIT I INTRODUCTION **9**

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation

UNIT II DISCRETE TIME SYSTEM ANALYSIS

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution –Fourier transform of discrete sequence – Discrete Fourier series.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION **9**

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure

UNIT IV DESIGN OF DIGITAL FILTERS **9**

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design –Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS **9**

Introduction to TMS320C54X Processor– Architecture – Features – Instruction sets – Addressing Formats – Functional modes – Simple Programs

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Classify the DT signals and systems according to their properties [Understand]
- Apply the knowledge of Z Transform and Fourier Transform to study the characteristic of discrete time systems. [Apply]
- Apply the knowledge of various FFT algorithms for efficient computation of DFT [Apply]
- Apply the knowledge of frequency transformation techniques to design the digital filters. [Apply]
- Apply the knowledge of DSP processors to develop programs for real time applications. [Apply]

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications" , Pearson Education, New Delhi, 2003.
2. S.K. Mitra, "Digital Signal Processing – A Computer Based Approach" , Tata McGraw Hill, New Delhi 2001

REFERENCE BOOKS:

1. Alan V. Oppenheim, Ronald W. Schafer,"Discrete time signal processing" Third Edition, 2010.
2. E.C. Ifeachor and B.W. Jervis, "Digital signal processing – A practical approach" Fourth Edition, 2007.
3. S. Salivahanan, A. Vallavaraj And C. Gnanapriya, "Digital Signal Processing" First Edition, Tata McGraw Hill, New Delhi 2008
4. B.Venkataramani, M.Bhaskar " Digital Signal Processors: Architecture Programming and Application", Tata McGraw Hill, 2011.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2										2		
CO.2	3	3	2	2								2		
CO.3	3	3	2	2								2		
CO.4	3	3	2	2								2		
CO.5	3	3	2									2		

15UCS627	PROBLEM SOLVING USING C (FOR EEE)	L	T	P	C
		0	0	2	1

PRE-REQUISITE: COMPUTER PROGRAMMING

OBJECTIVES :

- To familiarize the concepts of arrays, structures and unions in C language.
- To learn to access memory using pointers
- To know the manipulation of data in permanent storage

LIST OF EXPERIMENTS

- Programs using one dimensional and two dimensional arrays
- Programs using user defined functions and recursive functions
- Programs using pointers and dynamic memory allocation
- Programs using structures and unions
- Programs using files
- Programs for sorting and searching

TOTAL: 30 PERIODS

List of Sample Exercises :

1. An election is contested by 5 candidates. The candidates are numbered 1 to 5 and the voting is done by marking the candidate number on the ballot paper. Write a program to read the ballots and count the votes cast for each candidate using an array variable count. In case, a number read is outside the range 1 to 5, the ballot should be considered as a 'spoilt ballot' and the program should also count the number of spoilt ballots.
2. A company ABC pays their employers on a monthly basis. It pays their employers with DA=60% of BASIC PAY, HRA=20% of BASIC PAY, Allowance=Rs.2000.The company needs to automate the salary computation based on the basic pay. Develop an application to compute the gross salary of an employee given their basic pay
3. A banking application need to be developed for a bank. The operational features contain a list of the transactions that can be performed. These transactions are as follows:
    - Deposit funds to an account
    - Withdraw funds from an account
    - Transfer funds from one account to another

- Query the balance of any account

Develop an application to automate the above operational features.

4. A class contains a total strength of 60 in which there 35 girls and 25 boys. The department needs to assign roll number for the students based on their names in alphabetical order. Develop a software to automate the task
5. A telephone directory contains information such as name, phone number and address. For advertising a product a company needs software to get the phone number of the people in a specific location and display their name and phone number in sorted order
6. Write a program to display the day of the given date.
7. Write a 'C' program to find a greater digit in that number.
8. Write a program to declare a structure called cricket that contain the following information
    - Player name
    - Team name
    - batting average
    - highest score
    - no. of matches.

    Using cricket structure display the above details of 10 players.
9. Define a structure called hotel that contain the following members, name, address, average room charge, no. of rooms, etc. Write functions to perform the following
    - Display the details of 5 hotels
    - Display the details of the hotels with room charge less than a given value.
10. Declare a union data type time to maintain the time in hour, minutes and seconds. Develop a 'C' program to get a time from the user and display the time in the following format: 3:19:20.
11. Write a 'C' Program to Compare two text Files, Printing the character Position where they Differs.
12. Write a 'C' program using pointers to accept the height of a person in centimeter and categorize the person based on height as taller, shorter and average height person. Create array dynamically to store person's height detail.

COURSE OUTCOMES:

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

- Write C program to handle homogeneous data. [Apply]
- Write C program to handle heterogeneous data. [Apply]
- Apply the knowledge of modular programming. [Apply]
- Make use of pointers to perform memory handling operations. [Apply]
- Design applications using files. [Apply]

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS.

SOFTWARE

OS – UNIX CLONE (License free Linux)

APPLICATION PACKAGE – OFFICE SUITE

COMPILER – C

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3								2	2				
CO.2	3								2	2				
CO.3	3								2	2				
CO.4	3								2	2				
CO.5	3	2	2						3	3				

15UEE608	TECHNICAL PROJECT	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To inculcate the importance of communication skills
- To familiarize with the concepts in emerging engineering field

DESCRIPTION:

This course is introduced to enrich the communication skills of the student and to create awareness on recent development in Electrical and Electronics Engineering through Technical presentation. In this course, a student has to present at least two Technical papers or recent advances in Engineering / Technology that will be evaluated by a Committee constituted by the Head of the Department.

Students shall work in groups of 4 each and work on a small research problem. Students have to carry out the project under the guidance of faculty member using the knowledge of subjects that he/she has learned up to 5th semester .The student should submit the report at the end of the semester. The product should be demonstrated at the time of examination.

COURSE OUTCOMES:

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

- Understand the basic concept of core subject. [Understand]
- Explain the concept in an effective manner. [Understand]
- Apply innovative ideas on emerging engineering field. [Apply]
- Develop the novelty in mini projects. [Apply]
- Demonstrate the Technical ideas with good communication skill. [Understand]

TOTAL: 90 PERIODS

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3	3	3	3		3		2	1	3	2	1	2
CO.2	3	3		3	3	2	3	2	3	3	3	3	3	3
CO.3	3	3	3	3	3	2	3	2	3	3	3	3	3	3
CO.4	3	3	3				3	2	3	3	3	3	3	3
CO.5	3	3	3	3	3		3	2	3	3	3	3	3	3

15UME701	PROJECT MANAGEMENT AND FINANCE	L	T	P	C
	(Common to MECH, CSE,ECE, EEE, IT,& EIE)	3	0	0	3

OBJECTIVES :

- To impart knowledge to find solutions and approaches for various projects.
- To familiarize the utilization of project within time, resource and financial constraints.

UNIT I PROJECT MANAGEMENT CONCEPTS 9

Concept and characteristics of a project, importance of project management, types of project, project organizational structure, project life cycle, Statement of Work, Work Breakdown Structure.

UNIT II PROJECT PLANNING 9

Project Planning and Scheduling techniques - developing the project network using CPM/PERT, Limitations of CPM/PERT, Precedence Diagramming Method, constructing diagram and computations using precedence diagramming method, PERT/CPM simulation, reducing project duration.

UNIT III RESOURCE SCHEDULING & CRITICAL CHAIN SCHEDULING 9

Resource Scheduling - Resource allocation method, splitting and multitasking, Multi project resources scheduling - Critical Chain Scheduling -Concept of critical chain scheduling - critical chain scheduling method, application of Critical chain scheduling and limitations.

UNIT IV PROJECT QUALITY MANAGEMENT 9

Concept of project quality, responsibility for quality in projects, quality management at different stages of project, tools and techniques, Quality Management Systems, Project Performance Measurement and Control - Monitor and assess project performance, schedule, and cost. Project Closure/ Termination - Meaning of closure/ termination, project audit process, termination steps, final closure.

UNIT V FINANCIAL ACCOUNTING 9

Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis – Comparative financial statements.

Investments - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Explain the concept and characteristics of project management. [Understand]
- Understand the concepts of CPM and PERT to construct the project network. [Understand]
- Utilize the theory of Constraints and Heuristic methods for allocating resources to a project. [Apply]
- Demonstrate the various tools and techniques at different stages of Quality management. [Understand]
- Compute the balance sheet using trading, profit and loss account. [Apply]

TEXT BOOKS:

1. Prasanna Chandra, "'Fundamentals of Financial Management' ", Tata Mcgraw-Hill Publishing Ltd, 2005.
2. Jack Meredith, Samuel J.Mantel, "Project Management- A Managerial Approach", John Wiley and Sons.

REFERENCE BOOKS:

1. Clifford F Gray, Erik W Larson, "Project Management-The Managerial Process ", Tata Mcgraw-Hill Publishing Co Ltd.
2. John M Nicholas, "Project Management For Business And Technology", Prentice Hall of India Pvt Ltd.
3. Paresh Shah, "Basic Financial Accounting for Management", Oxford University Press, 2007.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2								2	1	3	2		
CO.2	2							2	2	2	3	2		
CO.3	3	2						3	2	2	3	2		
CO.4	2				2			2	2	2	3	2		
CO.5	3	2						2	2	2	3	2		

15UEE702	POWER SYSTEM OPERATION AND CONTROL	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To summarize the power system operation and control
- To impart knowledge on real power-frequency control and reactive power-voltage control
- To introduce the concepts of computer control of power systems

UNIT I INTRODUCTION 9+6

System load variation - load characteristics - load curves and load-duration curve (daily, weekly and annual) - load factor - diversity factor. Importance of load forecasting and simple techniques of forecasting. An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram). Concepts of restructuring power system.

UNIT II REAL POWER - FREQUENCY CONTROL 9+6

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single-area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 9+6

Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power, Introduction to voltage collapse. Relation between voltage, power and reactive power at a node - method of voltage control - tap-changing transformer - SVC (TCR + TSC) and STATCOM – secondary voltage control.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 9+6

Formulation of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients). Statement of Unit Commitment problem - Priority-list methods - forward dynamic programming approach.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9+6

Need of computer control of power systems - Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology - state estimation -WLSE - Contingency Analysis - State transition diagram showing various state transitions and control strategies.

TOTAL: 45(L)+30 (T) =75 PERIODS

COURSE OUTCOMES:

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

- Apply the knowledge of load characteristics and load forecasting for the planning of power system operation and control. [Apply]
- Analyze the static and dynamic load frequency control loops for controlled and uncontrolled power system cases. [Analyze]
- Model typical excitation system and select appropriate compensating device for voltage control. [Apply]
- Develop an economic load sharing schedule for economic operation of power system. [Apply]
- Summarize the need of computer control for enhancing the security of power system. [Understand]

TEXT BOOKS:

1. Allen. J. Wood. And Bruce F. Wollenberg, " Power Generation, Operation and Control ", John Wiley & Sons,2013.
2. Chakrabarti, Halder, " Power System Analysis: Operation and Control ", Prentice Hall of India, Third edition, 2010.

REFERENCE BOOKS:

1. Kothari D.P. Nagrath I.J, "Modern Power System Analysis ", Tata McGraw Hill Publishing Company Limited, Third Edition, 2003.
2. Grigsby L.L., "The Electric Power Engineering, Hand Book ", CRC Press & IEEE Press, 2001.
3. Hadi Saadat, " Power System Analysis",11th Edition, 2007.
4. Kundur P., " Power System Stability and Control ", MC Craw Hill Publisher, 2006.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3										1		
CO.2	3	2										1		
CO.3	3	2			3							1		
CO.4	2											1		
CO.5	3	3										1		

15UEE703 **ELECTRIC ENERGY UTILIZATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

To explain the application of electrical drives and concept of traction

To understand the illumination system by using various types of lamps

To familiarize with the different methods of electric heating and electric welding

To introduce knowledge on electrical energy conservation and tariff

To impart knowledge on Electric Vehicles and various energy storage systems

UNIT I ELECTRIC DRIVES AND TRACTION **9**

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification -electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

UNIT II ILLUMINATION **9**

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps –design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED.

UNIT III HEATING AND WELDING **9**

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating -resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types -resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV ELECTRIC ENERGY CONSERVATION **9**

Cost of electrical energy - Depreciation and determination methods - tariff- energy management and energy audit - economics of power factor correction.

UNIT V ELECTRIC VEHICLES AND ENERGY STORAGE SYSTEMS **9**

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Comparisons of EV with Internal combustion engine vehicles, Energy storage systems: Battery, Fuel cell, hydrogen storage systems and Ultra capacitors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply the knowledge of electric drives and mechanics of train movement for the selection of electric traction. [Apply]
- Design a suitable illumination system for a given location considering safety issues. [Create]
- Choose appropriate electric heating and welding process for industrial applications. [Apply]
- Select suitable electric energy conservation measures and tariff for the economic utilization of electric energy. [Apply]
- Choose appropriate energy storage system for electrical vehicles. [Apply]

TEXT BOOKS:

1. Suryanarayana N.V., "Utilization of Electric Power", Wiley Eastern Limited, New Age International Limited, 1994.
2. Gupta J.B, "Utilization Electric power and Electric Traction", S.K.Kataria and Sons, 2009.
3. G. C. Garg, "Utilization of Electric Power & Electric Traction" Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. Rajput R.K., "Utilisation of Electric Power", Laxmi publications Private Limited.,2007.
2. Partab H., "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co., New Delhi, 2004.
3. Wadhwa C.L., "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt.Ltd., 2003.
4. Sivanagaraju S., Balasubba Reddy M. and D. Srilatha, "Generation and Utilization of Electrical Energy", Pearson Education, 2010.
5. Ali Emadi, Mehrdad Ehsani, John M.Miller Vehicular Electric Power Systems, Special Indian Edition, Marcel dekker, Inc 2010.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3	3			3	2	3						
CO.2	3					2		2						
CO.3	3	2					2					2		
CO.4	3	2					2					2		
CO.5	3	3	3			3	2	3						

15UEE706	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To familiarize with the digital simulation of power system problems

LIST OF EXPERIMENTS:

1. Computation of Parameters and Modeling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis - I : Solution of Load Flow And Related Problems Using Gauss-Seidel Method
4. Load Flow Analysis - II: Solution of Load Flow and Related Problems using Newton-Raphson and Fast- Decoupled Methods
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi machine Power Systems
8. Electromagnetic Transients in Power Systems
9. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems.
11. Transient Stability Analysis of Single Machine Power Systems using MATLAB/ETAB /MI-POWER .
12. Economic Dispatch with emission control in Power Systems

A minimum of TEN experiments shall be offered

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Compute the parameters & modelling of Transmission Line and formation of Bus Admittance & Impedance Matrices. [Apply]
- Analyze the Load Flow problem using different numerical techniques for planning and operation of power system. [Analyze]
- Compute the fault current under balanced and unbalanced conditions. [Apply]
- Analyze the steady state and transient stability of SMIB and multi machine system for power system planning and operation. [Analyze]

- Analyze the load frequency control of single area and two area system for maintaining the system frequency in power system. [Analyze]
- Compute the solution for economic dispatch problem in power system. [Apply]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2			3			3	3	2				
CO.2	3	3		2	3			3	3	2				
CO.3	3	2		2	3			3	3	2				
CO.4	3	3		2	3			3	3	2				
CO.5	3	3			3			3	3	2				
CO.6	3	2			3			3	3	2				

SOFTWARE REQUIREMENT:

Sl. No.	Description of Equipment	Quantity required
1	Personal computers (Pentium-IV, 80GB, 512 MBRAM)	25
2	Printer laser	1
3	Dotmatrix	1
4	Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor)	1
5	Software: E.M.T.P/ETAP/CYME/MIPOWER /any power system simulation software	5 licenses
6	Compliers: C, C++, VB, VC++	25 users

15UEC727	SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To implement the signal processing techniques using the instructions of DSP processor
- To develop the knowledge of simulation software as a tool for signal processing.
- To implement the IIR and FIR filter using simulation software

LIST OF EXPERIMENTS

USING DSP PROCESSOR

- Study of various addressing modes of DSP using simple programming examples
- Sampling of input signal and display
- Implementation of FIR filter
- Calculation of FFT

USING SIMULATION SOFTWARE

- Generation of Signals
- Linear and circular convolution of two sequences
- Sampling and effect of aliasing
- Design of FIR filters
- Design of IIR filters
- Calculation of FFT of a signal

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Develop programs for signal processing techniques using simulation software. [Apply]
- Utilize simulation software to design digital IIR and FIR filters. [Apply]
- Develop and implement signal processing algorithms using digital signal processor. [Apply]

HARDWARE AND SOFTWARE REQUIREMENT FOR A BATCH OF 30 STUDENTS

1. PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)-15 Units (2 students per system)
2. Simulation software with Simulink and Signal Processing Tool Box-10 Users license
3. Function Generators (1MHz)- 15
4. CRO (20MHz) -15

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2	2		3				3	2		2		2
CO.2	3	2	2		3				3	2		2		2
CO.3	3	2	2		3				3	2		2		2

15UME801	PROFESSIONAL ETHICS	L	T	P	C
	(Common to ALL Branches)	2	0	0	2

OBJECTIVES :

- To impart knowledge on a values-based approach and provide a method of thinking about and dealing with ethical issues in the work place.
- To explain what a profession is and what it means to act professionally.

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 10

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Assessment of safety and risk – Risk Benefit analysis – Professional Rights – Employee rights – Intellectual Property Rights

UNIT III GLOBAL ISSUES 11

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Engineers as Managers – Consulting Engineers – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to

- Illustrate the basic perception of profession, professional ethics and various moral issu [Understand]
- Describe the code of ethics and role of professional ethics in engineering field. [Understa
- Apply ethical principles to resolve global and cross cultural issues that arise in profess career. [Apply]

TEXT BOOKS:

1. Subramanian. R , “Professional Ethics”, Oxford University press India, New Delhi First edition, 2013.
2. Dhinesh Babu.S, “Professional Ethics and Human Values”, Laxmi Publications, New Delhi, Reprint, 2016.

REFERENCE BOOKS:

1. Jayakumar.V, “Professional Ethics in Engineering”, Lakshmi Publications, Chennai.
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, 2003.
3. Edmund G Seebauer, Robert L Barry “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.
4. David Ermann, Michele S Shauf “Computers, Ethics and Society”, Oxford University Press, 2003.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2							3	1		2	2		
CO.2	2							3	2		2	2		
CO.3	3	2						3	2		2	2		

15UEE804	PROJECT WORK	L	T	P	C
		0	0	24	12

OBJECTIVE:

- To deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer based project or management project.

PROJECT DESCRIPTION :

Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project. The progress of the project is evaluated based on a minimum of three reviews.

TOTAL: 360 PERIODS

COURSE OUTCOMES

- Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge. [Apply]
- Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion. [Analyze]
- Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice. [Apply]
- Test and evaluate the performance of the developed solution using appropriate techniques and tools. [Create]
- Apply management principles to function effectively in the project team for project execution. [Apply]
- Write effective reports and make clear presentation to the engineering community and society. [Analyze]

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2	3				3						3	3
CO.2	3	3	2	3									3	3
CO.3	3				3			3					3	3
CO.4	3	3			3								3	3
CO.5	3								3		3		3	3
CO.6	3	3				3	3					3	3	3
CO.7	3									3			3	3

15UGS331	VALUE EDUCATION AND HUMAN RIGHTS (Common to ALL Branches)	L	T	P	C
		2	0	0	P/F

OBJECTIVES:

- To inculcate the values of Humanism, Culture and to have an awareness of Human Rights
- To impart knowledge and develop a sensitivity to the diverse Indian culture

UNIT I **6**

Introduction – Value education - Definition - Why values? - need for inculcation - sources of values- Personal values, Social values, Professional values, Moral values and Behavioral values.

UNIT II **6**

Values needed for life - love & Compassion, Truth & Tolerance, Fairness & Obedience – Respect Empathy – Protection – Humility & Harmony – Principles of happy living – Stress management

UNIT III **6**

Social values and personality – Role models – National leaders – freedom fighters, Social reformers & Value based anecdotes

UNIT IV **6**

Social values-Five responsibilities: to self family, environment, society and universe- peace within, family & universe; Unethical standards in words and how to correct in deeds, in thought, its deleterious effects in society, deterioration of culture and traditional values- remediation for better understanding of such values and its implications

UNIT V **6**

Human Rights – Universal Declaration of human rights - Human Rights violation - National Integration – Peace and non violence – the role of media in value building - Consumer awareness- **Case Study**

TOTAL :30 PERIODS

COURSE OUTCOMES:

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

- Acquire a holistic vision and growth to become an integrated personality.
- Imbibe the essence of spirituality by which they will manifest the noble virtues of a universal brotherhood and benevolence

TEXT BOOKS:

1. S. Ignachimuthu, Values for Life, St.Paul Publications, Mumbai, 1994

REFERENCE BOOKS:

1. Frankena, W.K., "Ethics ", Prentice Hall of India,, New Delhi, 1990.
2. Meron Theodor, "Human Rights and International Law Legal Policy Issues", Oxford University Press, First Edition, New Delhi, 2000.
3. R.P.Shukla, "Value Education and Human Rights, Sarup and Sons Publishing, New Delhi, 2004.
4. Yogesh Kumar Singh and Reschika Nath. "Value Education". APH Publishing Corporation, New Delhi, 2005.

15UEE901	NETWORK ANALYSIS & SYNTHESIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students capable of analyzing any given electrical network.
- To make the students to learn how to synthesize an electrical network from a given impedance/admittance function.
- To make the students to learn various filter design methodologies.

UNIT I NETWORK TOPOLOGY 9

General network analysis - Elementary concepts of network topology – Graph - Tree – Co Tree - Tree branch and link - Tie set schedule and cut set schedule - Loop current and node voltage methods -Parameter matrices - Equilibrium equations.

UNIT II S - DOMAIN ANALYSIS 9

S - domain network - Driving point and transfer impedances - Solutions of simple network equation - Initial condition in networks - Laplace transformations - Transformed circuits - Poles and zeros of a network function - Time response from pole - zero plot.

UNIT III NETWORK PARAMETERS 9

Characterisation of two port networks in terms of Z ,Y, h, ABCD and image parameters - Equivalent T and P circuits - Relation between two port network parameters - Analysis of T, bridged T ,ladder and lattice networks using parameters - Transfer function of terminated two port networks .

UNIT IV ELEMENTS OF NETWORK SYNTHESIS 9

Realizability of one port - Hurwitz polynomials – positive real functions (p.r.f.) - Necessary and sufficient conditions of p.r.f. - Testing of a p.r.f - Minimum p.r.f. - Properties of driving point impedances. Synthesis of driving point impedance Foster form - Synthesis of purely reactive networks in the Cauer form, continued fraction expansion.

UNIT V DESIGN OF FILTERS **9**

Types of filters - Constant K - m derived and composite filters - Terminating half sections - frequency and impedance scaling - Frequency transformation active filters - Sensitivity - Single amplifier filters - All pass and notch filter - Butter worth filter - Higher order filters.

Total:45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Analyze the various network topologies
- Apply S-domain analysis to get network parameters
- Characterize the two port network in terms of Z, Y, H ABCD and image parameters
- Analyze the elements of network synthesis
- Design a filter for given specifications

TEXT BOOKS:

1. Sudhakar A and Shyammohan S P, “Circuits and Networks Analysis and synthesis”, Tata McGrawHillPublishing Company Ltd.,2006.
2. UmeshSinha, “Network Analysis And Synthesis”,SathyaPrakasan Publishers Limited, New Delhi, Fifth edition, 1992.

REFERENCE BOOKS:

1. F.F. Kuo , “Network analysis and synthesis” , John Wiley & Sons , 1995
2. Van ValkenBarg , “Network analysis” , John Wiley & Sons , 1996.
3. Allan H. Robbins, Wilheln C Miller, “Circuit Analysis, Principles of Applications”,First Indian reprint 2008.
4. Paranjothi S.R., “Electric Circuit Analysis”, New age International Publishers Limited, New Delhi, 2nd edition 2000.

15UEE902	ADVANCED CONTROL THEORY	L	T	P	C
		3	0	0	3

PREREQUISITE: 15UEE403 – CONTROL SYSTEMS

OBJECTIVES:

- To introduce the fundamental knowledge on state space variable
- To explain the function analysis of non linear systems
- To discuss the stability of the system and optimal control.

UNIT I STATE VARIABLE ANALYSIS 9

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control.

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III DESCRIBING FUNCTION ANALYSIS 9

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

UNIT IV STABILITY ANALYSIS 9

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

UNIT V OPTIMAL CONTROL 9

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples. - Optimal estimation – Multivariable control design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze the state model for linear continuous system
- Analyze the causes of non linearity and methods of linearization
- Determine describing functions for common non linearities
- Analyze the stability of non linear system
- Explain the optimal control theory

TEXT BOOKS:

1. NagrathI.J.,Gopal , “Control Systems Engineering ”, New Age International Publishers,2008.
2. AshishTewari, “ Modern control Design with Matlab and Simulink’ ”, John Wiley , 2002

REFERENCE BOOKS:

1. George J. Thaler, “Automatic Control Systems”, Jaico Publishers, 1993 .
2. Gopal M., “ Modern control system theory” , New Age International Publishers, 2002.
3. Steve Heath, “
4. Design ”, 2nd Edition, Elsevier Publications, 2006
5. Gene F. Franklin, David Powell J. and Abbasemami-Naeini, “Feedback Control of Dynamic Systems ”, 4th Edition, Pearson Education, 2002
6. Nagoorkani A., “Advanced control Theory ”, RBA publishers, 1999.

15UEE903	HIGH VOLTAGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on over voltages, protection schemes, breakdown mechanism and measurement of over voltages in power system
- To familiarize about the various testing methods of power apparatus

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – protection against over voltages – Bewley's lattice diagram.

UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS 9

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC, AC, impulse voltages and currents. Tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC testing – International and Indian standards – Insulation Coordination

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Select an appropriate protective device against over voltage for the protection of power system. [Apply]
- Summarize the breakdown phenomenon in gases, liquids and solid insulators. [Understand]
- Choose appropriate method for the generation of high voltages and high currents. [Apply]
- Select a suitable instrument for the measurement of high voltages and high currents in electric power system. [Apply]

  Select an appropriate high voltage testing method for electric power apparatus in accordance with norms and standards. [Apply]

TEXT BOOKS:

1. Naidu M.S., Kamaraju V," High Voltage Engineering ", Tata McGraw Hill,4th Edition, 2009.
2. Uppal, S.L," Electric Power ", Khanna Publishers, 13th Edition, 2003.

REFERENCE BOOKS:

1. Kuffel ., Zaengel W.S," High Voltage Engineering Fundamentals ", Pergamon Press, 2nd edition, 2000 .
2. Wadhwa C.L, " High Voltage Engineering ", New Age International Pvt. Ltd., Third Edition, 2010
3. Chakrabati A., Soni M.L, Gupta P.V, " Text book on Power System Engineering ", DhanpatRai& Co Ltd,, 2011
4. Thapar B., Gupta B.R Khera L.K, " Power System Transients and High voltage Principles ", MohindraCaptial Publishers,, Revised Edition , 2009.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	2				2						2		
CO.2	2					1								
CO.3	3	2				2						3		
CO.4	3							3				2		
CO.5	3					3		3				3		

15UEE904	HVDC TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize the concept, planning of DC power transmission and comparison with AC power transmission.
- To explain HVDC converters and HVDC system control
- To discuss about harmonics and design of filters

UNIT I INTRODUCTION **9**

DC Power transmission technology – Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in HVDC technology – DC breakers – Operating problems – HVDC transmission based on VSC – Types and applications of MTDC systems.

UNIT II ANALYSIS OF HVDC CONVERTERS **9**

Line commutated converter - Analysis of Graetz circuit with and without overlap - Pulse number – Choice of converter configuration – Converter bridge characteristics – Analysis of a 12 pulse converters – Analysis of VSC topologies and firing schemes.

UNIT III CONVERTER AND HVDC SYSTEM CONTROL **9**

Principles of DC link control – Converter control characteristics – System control hierarchy – Firing angle control – Current and extinction angle control – Starting and stopping of DC link – Power control – Higher level controllers – Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL **9**

Reactive power requirements in steady state – Sources of reactive power – SVC and STATCOM – Generation of harmonics – Design of AC and DC filters – Active filters.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS **9**

Per unit system for DC quantities – DC system model – Inclusion of constraints – Power flow analysis – case study. **TOTAL: 45 PERIODS**

COURSE OUTCOMES:

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

- Describe the components of HVDC systems [Understand]
- Analyze the behavior of converters under different conditions [Analyze]
- Design AC and DC filters [Create]
- Modeling of HVDC System [Apply]
- Application of Simulation Tools in HVDC Transmission [Apply]

TEXT BOOKS:

1. Padiyar, K. R., “HVDC power transmission system”, New Age International (P) Ltd., New Delhi,Second Edition, 2010.
2. Edward Wilson Kimbark, “Direct Current Transmission”, Vol. I, Wiley inter science, New York, London, Sydney, 1971.
3. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age International (P) Ltd., New Delhi, 1990.

REFERENCE BOOKS:

1. Kundur P., “Power System Stability and Control”, McGraw-Hill, 1993.
2. Colin Adamson and Hingorani N. G., “High Voltage Direct Current Power Transmission”, GarrawayLimited, London, 1960.
3. Arrillaga, J., “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
4. Kamakshaiah S., and Kamaraju V., “HVDC Transmission”, Tata McGraw Hill Education private Limited, 2011.

15UEE905	SOFTWARE CIRCUIT FOR SIMULATION	L	T	P	C
		3	0	0	3

COURSE OBJECTI VES:

To impart knowledge on

- Advanced techniques in simulation
- PSPICE
- MATLAB
- SIMULINK

UNIT I INTRODUCTION **9**

Importance of simulation – General purpose circuit analysis – programs – Method of analysis of power electronic systems – Review of modeling of power electronic components and systems.

UNIT II ADVANCED TECHNIQUES IN SIMULATION **9**

Analysis of power electronic systems in a sequential manner coupled and decoupled systems – Various algorithms for computing steady state solution in power electronic systems – Future trends in computer simulation.

UNIT III PSPICE **9**

Introduction – Pspice overview – DC circuit Analysis –AC circuit analysis – Transient and the timedomain – Fourier Series and Harmonic components – An introduction to Pspice devices BJT, FET,MOSFET and is model – Amplifiers and Oscillators – Non linear Devices.

UNIT IV MATLAB **9**

Introduction - function description – Data types – Tool boxes – Graphical Display: Import and Export of data – Programs for solution of state equations.

UNIT V SIMULINK **9**

Introduction – Graphical user Interface – Selection of objects – Blocks – lines Simulation - Application programs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Model the circuit operation to replicate the behavior of actual electronic circuits [Apply]
- Analyze various power electronic systems [Analyze]
- Design the electronic circuits using PSPICE [Apply]
- Design electrical and electronics systems mathematically and perform simulation using MATLAB [Apply]
- Interpret drawings and workout other technical details [Apply]

TEXT BOOKS:

1. Rajagopalan V., “Computer aided analysis of power electronic systems”,Marcell Dekker 1987.
2. Barret J.P. ,Bornard and Meyer B., “Power System Simulatio” Ch apman & Hall Publication,First Edition, 1997

REFERENCES BOOKS:

1. John Keown, “MicrosimPspice and circuit analysis”, Prentice hall Inc, 1998.
2. “OrcadPspice User manual “, Orcad Corporation, 2006.
3. “ Matlab / Simulink manual “, Maths Work 2007.
4. EmilsonPereira Leite , “MATLAB –Modeling,Programming& Simulation” ,First Edition,2010.

15UEE906	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- To explore the theory and applications of special electrical machines.
- To review the fundamental concepts of permanent magnets and the operation of permanent magnet brushless DC motors.
- To introduce the concepts of permanent magnet brushless synchronous motors and synchronous reluctance motors.
- To develop the control methods and operating principles of switched reluctance motors.
- To introduce the concepts of stepper motors and its applications.
- To understand the basic concepts of other special machines.

UNIT I PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Characteristics and control.

UNIT II PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – EMF and torque equations - Phasor diagram - Power controllers–performance characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features –Principle of operation- Torque prediction –performance Characteristics- Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT IV STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque equation – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear induction motor – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze the performance characteristics of Brushless DC Motor for suitable applications. [Analyze]
- Analyze the performance characteristics of Permanent Magnet Synchronous Motor and synchronous reluctance motor for various applications. [Analyze]
- Choose appropriate power control circuit for closed loop operation of Switched Reluctance Motor. [Apply]
- Analyze the performance characteristics of stepper motor for various applications. [Analyze] Analyze the performance characteristics of Hysteresis, AC series and Linear induction motors for various applications. [Analyze]

TEXT BOOKS:

1. T.J.E. Miller, Brushless magnet and Reluctance motor drives, Claredon press, London, 1989.

2. R.Krishnan, Switched Reluctance motor drives, CRC press, 2001.

3. T.Kenjo, Stepping motors and their microprocessor controls, Oxford University press, New Delhi, 2000.

4. K. Venkataratnam ,Special Electrical Machines, Universities Press, 2014.

REFERENCE BOOKS:

1. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon press, London, 1988.

2. R.Krishnan, Electric motor drives, Prentice hall of India, 2002.

3. D.P.Kothari and I.J.Nagrath, Electric machines, Tata Mc Graw hill publishing company, New Delhi, Third Edition, 2004.

4. Irving L.Kosow, Electric Machinery and Transformers, Pearson Education, Second Edition, 2007.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3	3			2								3	2
CO.2	3	2											2	2
CO.3	3												2	2
CO.4	3	3	2		2								3	
CO.5	3												3	

15UEE907 COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS **L T P C**

2 0 2 3

PREREQUISITE: 15UEE504 –ELECTRICAL MACHINE DESIGN

OBJECTIVES:

- To impart knowledge on Design procedure of Various Electrical machines, vector fields - electrostatic and magneto static fields and concepts of electrodynamics
- To familiarize the knowledge about CAD Packages

UNIT I INTRODUCTION 10

Review on electromagnetic theory – Basic field equations, calculation of field distribution, inductance, capacitance, force and torque, Review on conventional electrical machine design methodology – computer aided design aspects - advantages.

UNIT II CAD PACKAGES 10

Numerical methods for solving field problems, recent developments, problem formulation – governing equations – modeling – boundary conditions and material characteristics.

UNIT III FINITE ELEMENT ANALYSIS 10

Mathematical formulation for 2-D planar and axial symmetry problems – discretization –shape functions – element and global matrices/vectors – solution – post processing.

LAB EXPERIMENTS

1. Linear and non-linear problems
2. Eddy current analysis
3. Calculation of force/torque
4. Design of cylindrical magnetic devices
5. Design of transformer
6. Design of Rotating machines.

TOTAL :30(L)+30 (P)=60 PERIODS

COURSE OUTCOMES:

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

- Compare conventional design procedure with computer aided design [Understand]
- Express electrical field problems in mathematical equations [Understand]
- Analyze the Finite Element Methods [Analyze]
- Calculate electrical parameters using CAD tools [Apply]
- Calculate the torque of Rotating machines [Apply]

TEXT BOOKS:

- Salon S.J.,"Finite Element Analysis of Electrical Machines", Kluwer Academic Publishers,1995.
- Nicola Bianchi., " Electrical Machine Analysis using Finite Elements", CRC Taylor& Francis, 2005.
- Vishnu Murthy K.M., "Computer Aided Design of Electrical Machines ", BS Publications, 2008

REFERENCE BOOKS:

- Joao Pedro, Bastos A and Nelson Sadowski, "Electromagnetic Modeling by Finite Element Methods", Marcell Dekker Inc, 2003 .
- Silvester P.P, Ferrari, "Finite Elements for Electrical Engineers" ,Cambridge University Press, 1983.
- Lowther D.A. and Silvester P.P, " Computer Aided Design in Magnetics ", Springer Verlag, 1986
- Hoole S.R.H, "Computer Aided Analysis and Design of Electromagnetic Devices", Elsevier,New York, 1989.

15UEE908	INTRODUCTION TO MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

Objectives

- To impart knowledge on the fundamental science and engineering relevant to fabrication of min
- To explain the relationship between nano/microstructure, characterization, properties and proce
- To discuss the possess knowledge of sensors and actuators

UNIT I INTRODUCTION **9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I **9**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micro magnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

UNIT III SENSORS AND ACTUATORS-II **9**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , coustic, Tactile and Flow sensors

UNIT IV MICROMACHINING **9**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micromachining processes – Structural and Sacrificial Materials – Acceleration of

sacrificial Etch – Striations and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Select appropriate materials for design and construction of micro electro mechanical system [Apply]
- Describe the operation of electrostatic sensors and actuators [Understand]
- Explain the operation of Piezo-resistive sensors and actuators [Understand]
- Compare the various types of etching methods [Understand]
- Distinguish the operating principles of polymer and optical MEMS [Understand]

TEXT BOOKS:

1.Chang Liu, “Foundations of MEMS”, Pearson Education Inc., 2006.

2. Stephen Beeby and Graham Ensell, “ MEMS Mechanical sensors”, Artech House,INC,2004..

REFERENCE BOOKS:

- NadimMaluf, “ An introduction to Micro electro mechanical system design”, Artech House, 2000.
- Mohamed Gad-el-Hak, “ The MEMS Handbook”, CRC press Baco Raton, 2000 Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture”, Tata McGraw Hill, New Delhi, 2002.
- Julian w. Gardner, Vijay k. varadan and Osama O. Awadelkarim, “ Micro sensors MEMS and
- smart devices”, John Wiley & son Ltd,2002
- James J.Allen, “Micro electro mechanical system design”, CRC Press, 2005

15UEE909	MICRO GRID AND DISTRIBUTED GENERATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To illustrate the concept of distributed generation.
- To outline the impact of grid integration.
- To explain the concept of Microgrid and its operation & control.

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants.

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV INTRODUCTION OF MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids.

UNIT V OPERATION AND CONTROL OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Identify the limits on operational parameters of Micro Grid. [Apply]
- Compare AC and DC Micro Grid. [Understand]
- Control the active and reactive power of Micro grid. [Apply]
- Analyze the impact of grid integration. [Analyze]
- Describe the requirements for grid interconnection. [Understand]

REFERENCE BOOKS:

- Amirnaser Yezdani, Reza Iravani, “Voltage Sourced Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2010.
- Dorin O. Neacsu, “Power -Switching Converters: Medium and High Power”, CRC Press, 2006.
- Chetan Singh Solanki, “Solar Photo Voltaic”, PHI learning Pvt. Ltd., New Delhi, 2009.
- Manwell J. F, McGowan J.G , Rogers A.L , “ Wind Energy Explained: Theory, Design and Applications”, Wiley Publications,2002.

5. Hall D.D, Grover R. P, “Biomass Regenerable Energy”, John Wiley, New York, 1987.

15UEE910	VLSI DESIGN AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the principle of operation of MOS transistor
- To familiarize with the concepts of combinational and sequential logic circuits
- To introduce the concepts on implementation strategies

UNIT I MOS TRANSISTOR PRINCIPLE 9

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous
design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS 9

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff.

UNIT V VERILOG HARDWARE DESCRIPTION 9

Overview of digital design with Verilog HDL – Hierarchical modeling concepts– modules and port definition – Gate level modeling– data flow modeling – behavioral modeling – Sample programs for combinational and sequential circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the basic concepts in MOS transistor principles and CMOS technology [Understand]
- Analyze the device parameters of Combinational Logic Circuits [Analyze]
- Elaborate the concepts in Sequential Logic Circuits [Understand]
- Design the Arithmetic Building blocks of CMOS design [Apply]
- Develop Verilog code for combinational and sequential circuits. [Apply]

TEXT BOOKS:

1. Jan Rabaey, AnanthaChandrakasan, Nikolic B., “Digital Integrated Circuits: A Design Perspective”, Second Edition, Prentice Hall of India, 2003.
2.Smith M.J., “Application Specific Integrated Circuits”, Addisson Wesley, 1997
3. Samir Palnitkar, “Verilog HDL”, Pearson Education, 2nd Edition, 2004

REFERENCE BOOKS:

1. Weste N. and Eshraghian K., “Principles of CMOS VLSI Design”, Second Edition, Addision Wesley 1993
2. Jacob Baker R., Harry W.LI. and David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India, 2005
3. Pucknell A., Kamran Eshraghian, “BASIC VLSI Design”, Third Edition, Prentice Hall of India, 2007.
4. Debprasad Das, “VLSI Design”, Oxford University Press, 2010.

15UEE911 ADAPTIVE CONTROL L T P C

3 0 0 3

PREREQUISITE: 15UEE403 – CONTROL SYSTEMS

OBJECTIVES:

- To introduce non parametric methods
- To impart knowledge on parameter estimation methods, recursive identification methods and adaptive control schemes
- To familiarize the some issues in adaptive control and applications.

UNIT I NON PARAMETRIC METHODS 9

Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis.

UNIT II PARAMETER ESTIMATION METHODS 9

Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identifiability considerations – direct identification – indirect identification.

UNIT IV ADAPTIVE CONTROL SCHEMES 9

Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

UNIT V ISSUES IN ADAPTIVE CONTROL AND APPLICATIONS 9

Stability – Convergence – Robustness –Applications of adaptive control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Understand the general meaning of non-parametric methods and when they might be used [Understand]
- Appreciate some practical problems associated with parametric methods [Understand]
- Identify the system transfer function using recursive method [Understand]
- Explain the basic scheme of adaptive control system [Understand]
- Compute the issues in adaptive control and application [Apply]

TEXT BOOKS:

1. Soderstorm T and Peter Stoica, “System Identification”, Prentice Hall, London, 1989.
2. Astrom K.J. and Wittenmark B., “Adaptive Control”, Pearson Education, 2nd Edition, 2001.

REFERENCE BOOKS:

1. Ljung L., “System Identification: Theory for the user", Prentice Hall, Englewood Cliffs, 1987.
2. Bela G. Liptak., “Process Control and Optimization, Instrument Engineers Handbook”, Volume 2, CRC press and ISA, 2005.
3. William S.Levine, “Control Systems Advanced Methods, the Control Handbook”, CRC Press, 2011.
4. Sastry S. and Bodson, M.,“ Adaptive Control– Stability, Convergence and Robustness”, Prentice Hall inc., New Jersey, 1989.

	OPERATION AND MAINTENANCE OF ELECTRICAL				
15UEE912	**EQUIPMENTS**	**L**	**T**	**P**	**C**
	(Qualitative treatment only)				
		3	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on

- Operation and Maintenance of electrical equipments in Generation, Transmission and Distribution.
- Practical aspects of condition monitoring and maintenance of various electrical equipments
- Testing of various electrical equipments and Methods of Trouble shooting techniques

UNIT I MAINTENANCE AND INDUSTRIAL SAFETY 9

Importance of plant maintenance, Types - Preventive, Break down and Production maintenance, Maintenance records, Role of maintenance engineer, cause of accidents and prevention. Protective devices for personnel and resources-Government Acts on Safety measures in Industry-Role of Safety Engineer – General safety precautions

UNIT II GENERATOR, SUBSTATION AND SWITCH GEAR 9

Operation procedure, Routine & Breakdown Maintenance, Causes of failure and Precautions measure.

UNIT III TRANSFORMER 9

Operation, Preliminary inspection-Inspection on arrival and before installation & Impulse voltage testing, Lightning arrester maintenance & trouble shooting, Oil purification & Testing, Gas analysis by colour of gas by using gas analyser.

UNIT IV TRANSMISSION AND DISTRIBUTION 9

Rules for low, medium and high voltages, Factor of safety, Special precautions, Minimum clearance, Conductors, System protection, Lightning arrester, Methods of laying Underground cable and fault location illumination **-** Special lighting applications, Installations, Trouble shooting, Modern developments.

UNIT V DC & AC MOTORS & STARTERS 9

Operation procedure, Routine & Breakdown Maintenance, Maintenance of contactors-Common starter troubles and remedies, Causes of failure and Precautions and Troubleshooting - Trouble shooting in pump motors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Discuss the need of industrial safety and various methods of safety maintenance [Understand]
- Analyze the over current protective devices and their application in a coordinated Protection scheme [Analyze]
- Analyze the various Troubleshooting methods of Transmission and Distribution. [Analyze]
- Illustrate strategies for effective transformer maintenance and repair. [Understand]
- Identify the various Troubleshooting methods of DC & AC Motors and Starters. [Understand]

TEXT BOOKS:

- Rao V.S., “Operation & Maintenance of Electrical Equipment – Volume I & II ”, Media Promotors & Publishers Pvt. Ltd.,1997 Edition, Mumbai
- Kakkar K.C, “ Electrical Equipments Operation and Maintenances ”, RB Publication, New Delhi

REFERENCE BOOKS:

- Viswanathan T.S. and Ramachandran P., “Control & Maintenance of Electrical Machines ”, Priya Publishers, 1998 Edition, Trichy
- Rao S., “Testing Commissioning and Maintenance of Electrical Equipment ”, Fifth Edition, Khanna Publishers, 1997
- Tarlok Singh, “ Installation Commissioning & Maintenance Of Electrical Equipments ”, 2nd Edition,
- Sawhney A.K., “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpat Rai and Co, 2004

15UEE913	POWER SYSTEM TRANSIENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts on generation of switching transients and the control strategies over them.
- To impart knowledge on mechanism of lighting strokes and the production of lighting surges.
- To familiarize with the propagation, reflection and refraction of travelling waves.

UNIT I INTRODUCTION AND SURVEY **9**

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - 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.

UNIT II SWITCHING TRANSIENTS **9**

Overvoltages 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.

UNIT III LIGHTNING TRANSIENTS **9**

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.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS **9**

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.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Discuss the important of power system transients and their causes. [Understand]
- Explain overvoltage due to switching transient. [Understand]
- Analyze the effect of lightning transient in power system. [Analyze]
- Determine the transient response of power systems with series and shunt lumped parameters and distributed transmission lines. [Apply]
- Compute transient parameters of integrated power systems. [Apply]

TEXT BOOKS:

- Allan Greenwood, “Electrical Transients in Power Systems”, Wiley Interscience, 2nd Edition, New York, 1991.

2. Begamudre R.D, “Extra High Voltage AC Transmission Engineering ”, New Academic Science, Fourth Edition,2011.

REFERENCE BOOKS:

- Naidu M.S. and Kamaraju V, “High Voltage Engineering ”, Tata McGraw Hill, 2nd Edition, 2000.
- Pritindra Chowdhuri, “ Electromagnetic transient in Power System ”, Research Studies Press Ltd , 1996
- Indulkar C.S.,Kothari D.P. and Ramalingam K, “Power System Transient a Statistical approach ”, PHI Ltd , 2010
- Harold A. Peterson, “Transient in Power Systems”, Wiley, 1951.

15UEE914	NUMERIC RELAYS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the various static relays and comparators that is used for protection
- To explain the principle of various protective relays and their operation against faults in the Power System scenario
- To introduce the knowledge on microprocessor based relays

UNIT I INTRODUCTION TO STATIC RELAYS 9

Advantages of Static Relays - Generalized characteristics and operational equations of relays - steady state and transient performance of signal driving elements - Signal mixing techniques and measuring techniques - CT's and PT's in relaying schemes - Saturation effects.

UNIT II STATIC RELAY CIRCUITS I 9

Static relay circuits (using Analog and Digital IC's) for over current, inverse - time characteristics, differential relay and directional relay.

UNIT III STATIC RELAY CIRCUITS II 9

Static relay circuits for generator loss of field, under frequency, distance relays, impedance, reactance, mho, reverse power relays.

UNIT IV CARRIER CURRENT PROTECTION AND TESTING 9

Static relay circuits for carrier current protection - Steady state and transient behaviour of static relays - Testing and maintenance - Tripping circuits using Thyristors**.**

UNIT V MICROPROCESSOR BASED RELAYS 9

Hardware and software for the measurement of voltage, current, frequency, phase angle - Microprocessor implementation of over current relays - Inverse time characteristics - Impedance relay - Directional Relay - Mho Relay.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the various relaying schemes. [Understand]
- Compare the merits and demerits of solid state relay over electromagnetic relays. [Understand]
- Explain principle of various protective relays and their operation against faults in the Power System Scenario. [Understand]
- Choose relays based on the Scheme of protection such as distance, differential and directional using Analog and Digital configuration. [Apply]
- Employ various Protection schemes for power system components using Microprocessor based relay. [Apply]

TEXT BOOKS:

- Rao T.S.M., " Power System Protection- Static Relays ", Tata McGraw Hill. Ltd.,2010..
- Rao, "Digital Numerical Relays ", McGraw Hill, First Edition, 2005 .

REFERENCE BOOKS:

- Van C. Warrington C., "Protective Relays - Their Theory and Practice ", Chapman and Hall,
- Ravindranath B. and Chander M, "Power System Protection and Switchgear",Wiley Eastern, 2007 .
- Badri Ram and Vishwakarma D.N, "Power System Protection and Switchgear ", Tata McGraw-Hill Education, April 1 ,2001
- Anthaony F. Selva, " Protective Relay Principles ", CRC Press ,Taylor & Francis Group, 2009.

15UEE915	NEURAL NETWORK AND FUZZY SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concept of fuzzy set theory and fuzzy logic contoller.
- To impart the knowledge on ANN and ANN types.
- To discuss the application of fuzzy logic and artificial neural networks

UNIT I INTRODUCTION **9**

Classical Sets and Fuzzy Sets - Classical and Fuzzy Relations, Membership function, Fuzzy number Fuzzy operation and composition.

UNIT II FUZZY LOGIC CONCEPTS **9**

Fuzzy Variables, Linguistic variables, Fuzzy Rule-Based System, fuzzification concepts of defuzzification, fuzzy logic controller.

UNIT III ARTIFICIAL NEURAL NETWORKS **9**

Fundamentals of Artificial Neural networks- Biological prototype – Artificial neuron, Activation functions, Single layer and multiplayer networks. Training Artificial neural networks, Preceptrons, Exclusive Or Problem – Linear seperability, Preceptron learning, perceptron training algorithms. Back propagation, Training algorithm, network configurations, Network paralysis, Local minima, temporal instability.

UNIT IV ARTIFICIAL NEURAL NETWORK TYPES **9**

Hopfield nets, Recurrent networks, Stability, Associative memory, Thermodynamic systems, Statistical Hopfiled networks, Applications. Bi-directional associative memories, Retrieving on stored association, Encoding the associations.

UNIT V APPLICATIONS OF FUZZY LOGIC AND ARTIFICIAL NEURAL NETWORKS **9**

Fuzzy Logic Applications in Power Systems Automatic Generation Control Using Fuzzy Logic Controllers Fuzzy logic control of Washing Machine. Neural network applications in power system and inverted pendulum applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Compare the basic concepts of classical set theory and fuzzy set theory. [Understand]
- Construct the fuzzy logic controllers using fuzzy rule-based system. [Apply]
- Outline the architecture of basic Artificial Neural Network (ANN) and its learning methods. [Understand]
- Explain the architecture and learning methodologies of various types of memories and ANN. [Understand]
- Design a fuzzy logic and neural network controller for real time applications. [Create]

TEXT BOOKS:

- Timothy J. Ross, “Fuzzy logic with Engineering Applications ”, John Wiley & sons Ltd, 3rd edition, 2010.
- Kosko B., “Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence”, Prentice-Hall of India Pvt. Ltd, 1992.

REFERENCE BOOKS:

- Laurence Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms, and Applications”, Prentice Hall Publishers Ltd,1993
- Zmmermann H.J., “Fuzzy Set Theory and its Applications”, Allied Publishers Ltd, New Delhi, 1991
- George J. Klir, Tina A. Folger, “Fuzzy Sets, Uncertainty and Information ”, Prentice Hall Ltd., 1988
- Zurada J.M., “Introduction to Artificial Neural Systems ”, Jaico Publishing,1994
- Haykin S., “Artificial Neural Network: A Comprehensive Foundation”, Pearson Publication Asia, 2ND Edition, India, 2001.
- Sivanandam S.N, Sumathi, and Deepa.S.N, “An Introduction to Neural Networks using MATLAB 6.0”, 1st edition, Tata McGraw Hill Publishers Ltd, 2006

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2	1										3		
CO.2	3	2			3							1		
CO.3	2				3							2		
CO.4	2											1		
CO.5	3	3	3	3	3				2	2				3

15UEE916	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To expose the students to the fundamentals of embedded Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To study the basic concepts of embedded C ,Embedded OS and PYTHON programming

UNIT I EMBEDDED PROGRAMMING 9

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

UNIT II C PROGRAMMING TOOLCHAIN IN LINUX 9

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Memory Leak Detection with valgrind - Introduction to GNU C Library

UNIT III EMBEDDED C 9

Adding Structure to ‘C’ Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

UNIT IV EMBEDDED OS 9

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS- Memory requirements - embedding serial communication & scheduling data transmission - Case study: Intruder alarm system.

UNIT V PYTHON PROGRAMMING 9

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison

with C programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment. NOTE Discussions/Practice on Workbench : Program Development and practice in exercises with C, C++ and Python Programming Environments.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the fundamentals of embedded Programming. [Understand]
- Explain the GNU C Programming Tool Chain in Linux. [Understand]
- Discuss the basic concepts of embedded C. [Understand]
- Discuss the basic concepts of Embedded OS. [Understand]
- Analyze PYTHON programming. [Analyze]

REFERENCES :

1. Steve Oualline, 'Practical C Programming 3rd Edition', O'Reilly Media, Inc, 2006.
2. Stephen Kochan, "Programming in C", 3rd Edition, Sams Publishing, 2009.
3. Michael J Pont, "Embedded C", Pearson Education, 2007.
4. Mark Lutz,"Learning Python,Powerful OOPs,O'reilly,2011.

15UEE917	POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To Provide knowledge about the stand alone and grid connected renewable energy systems.

- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

UNIT I INTRODUCTION 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources ocean, Biomass, Hydrogen energy systems : operating principles and characteristics of: Solar PV, Fuel cells, wind electrical systems-control strategy, operating area.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS 9

Solar: Block diagram of solar photo voltaic system : line commutated converters (inversionmode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing. Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS-Grid Integrated solar system.

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PVMaximum Power Point Tracking (MPPT).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Compare the merits and demerits of various renewable energy sources. [Understand]
- Analyze the various characteristics of IG, PMSG, SCIG and DFIG. [Analyze]
- Design power converters for renewable energy systems. [Create]
- Design grid integrated solar system. [Create]
- Develop maximum power point tracking algorithms. [Apply]

REFERENCES:

1. S.N.Bhadra, D. Kastha, & S. Banerjee “Wind Electrical Systems”, Oxford University Press, 2009
2. Rashid .M. H “power electronics Hand book”, Academic press, 2001
3. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993.
4. Rai. G.D,” Solar energy utilization”, Khanna publishes, 1993.
5. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.
6. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi.

15UEE918	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the various power quality phenomenon, their origin and monitoring and mitigation methods.
- To discuss the effects of various power quality phenomenon in various equipments

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients – short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve – Information Technology Information (ITI) Curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and interruptions - estimating voltage sag performance -Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES 9

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltages wells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding – line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT IV HARMONICS 9

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING **9**

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems- modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer –quality measurement equipment - harmonic / spectrum analyzer - flicker meters – disturbance analyzer. Applications of expert systems for power quality monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Summarize various categories of power quality problems. [Understand]
- Identify the Sources and Mitigation Techniques for Sag and Interruptions in Power quality. [Apply]
- Apply appropriate mitigation techniques for Over voltages in power system. [Apply]
- Examine the effects of harmonics on the power distribution system. [Analyze]
- Choose appropriate device to monitor power quality issues in industries. [Apply]

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso and H.WayneBeaty, “Electrical Power Systems Quality”, McGraw Hill,2012
2. Arrillaga J., N.R. Watson and S. Chen, “Power System Quality Assessment”, New York: Wiley,2000.

REFERENCE BOOKS:

1. Heydt G.T., “Electric Power Quality”, 2nd Edition, Stars in a Circle Publications, 1994.
2. Bollen M.H.J., “Understanding Power Quality Problems: Voltage Sags and Interruptions”, New York: IEEE Press, 1999.
3. Sankaran C., “Power Quality”, CRCPress, Taylor Francis Group,2002
4. PSCAD User Manual

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2							3						2
CO.2	3	2					2							
CO.3	3	2					2							
CO.4	3	3					2	3						3
CO.5	3	2			3			2						

15UEE919	FLEXIBLE AC TRANSMISSION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the reactive power control techniques
- To impart knowledge on static VAR compensators, Thyristor controlled series capacitors, STATCOM devices, FACTS controllers and their applications
- To discuss the transient stability on power system and to familiarize with the FACTS controller interaction and co- ordination

UNIT I INTRODUCTION **9**

Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC) – Unified power flow controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS **9**

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modeling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS **9**

Operation of the TCSC – Different modes of operation – Modeling of TCSC – Variable reactance model – Modeling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS **9**

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability - prevention of voltage instability. SSSC-operation of SSSC and the control of power flow –modeling of SSSC in load flow and transient stability studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS **9**

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms. Unified power flow controller (UPFC)-Independent real and reactor power flow control- control schemes for P and Q control. Inter line power flow controller (IPFC).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Describe the operating characteristics of various FACTS controller and their roll on enhancing maximum power transfer capacity. [Understand]
- Analyze the impact of FACTS components on power system stability and damping. [Analyze]
- Analyze the modeling of power flow studies. [Analyze]
- Compute basic mathematical models for FACTS devices [Apply]
- Analyze the interactions and coordination amongst various FACTS Controllers [Analyze]

TEXT BOOKS:

1. Mohan Mathur R. and Rajiv K.Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc, 2002.
2. Narain G. Hingorani, “Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors, Delhi- 110 006,

REFERENCE BOOKS:

1. John A.T., “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE), 1999.
2. Sood . V.K., “HVDC and FACTS controllers – Applications of Static Converters in Power System”, April 2004 , Kluwer Academic Publishers, 2004.
3. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, “Flexible AC Transmission System: Modelling and Control” Springer, 2012.
4. Padiyar K.R.,” FACTS Controllers in Power Transmission and Distribution”, New Age International(P) Limited, Publishers, New Delhi, 2008.

15UEE920	EVOLUTIONARY COMPUTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the evolutionary computation techniques methodologies
- To explain the procedure of selection scheme and search operator.
- To impart knowledge on developing evolutionary algorithms for real-world applications

UNIT I INTRODUCTION TO EVOLUTIONARY COMPUTATION 9

Biological and Artificial evolution – Evolutionary computation' and AI different historical branches of EC, e.g., GAs, EP, ES, GP, etc. – A simple evolutionary algorithm. Representation techniques, The importance of representation – Coding methods – Binary, gray, binary Vs gray, integer, real valued coding, structured coding – Representation of combinatorial problems – Adaptive representations.

UNIT II SELECTION SCHEMES 9

Fitness proportional selection and fitness scaling – Ranking, including linear, power, exponential and other ranking methods – Tournament selection – Selection pressure and its impact on evolutionary search.

UNIT III SEARCH OPERATORS 9

Recombination/Crossover for strings (e.g., binary strings) – One-point. multi-point, and uniform crossover operators – Mutation for strings - bit-flipping – Recombination / crossover and mutation rates – Recombination for real-valued representations – Discrete and intermediate recombination – Mutation for real-valued representations – Gaussian and Cauchy mutations. Self-adaptive mutations – Mixing different search operators -– An anomaly of self-adaptive mutations.

UNIT IV THEORETICAL ANALYSIS OF EVOLUTIOARY ALGORITHMS 9

Schema theorems – Co-evolution – Cooperative co-evolution, Competitive co-evolution – Niching and speciation – Fitness sharing – Crowding and mating restriction – Convergence of EAS

UNIT V APPLICATIONS AND ADDITIONAL FEATURES OF EAS 9

Evolutionary algorithms for traveling salesman problem, scheduling problem. inventory problem – Hybrid evolutionary and local search algorithms – Constraint handling – Penalty methods, repair methods – EAS for multi-objective problems – Weighted objectives, pareto optimality

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the history of evolutionary computation and types of evolutionary techniques. [Understand]
- Discuss the various selection schemes of evolutionary computation. [Understand]
- Describe the cross over and mutation operator of evolutionary computation. [Understand]
- Analyze theorems related to EAS. [Analyze]
- Apply the additional features of EAS. [Apply]

TEXT BOOKS:

1. Baeck T., Fogel.D. B. and Michalewicz .Z., "Handbook on Evolutionary Computation", IOP Press, New Delhi, 1997
2. Carlos A. Coello Coello, Gary B. Lamont and David A. Van Veldhuizen, “Evolutionary Algorithms for Solving Multi-Objective Problems” ,Springer, 2nd edition, 2007.

REFERENCE BOOKS:

1. Michalewicz Z., "Genetic Algorithms + Data Structures = Evolution Programs", Third Edition, Springer-Verlag, Berlin, 1996
2. Banzhaf W., Nordin P., Keller R. E. and Frank D. Francone, "Genetic Programming: An Introduction: on the automatic evolution of computer programs and its applications", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA, 1998.
3. Yao X., "Evolutionary Computation: Theory and Applications", World Scientific Publishing Co., Singapore, 1999
4. Goldberg D E, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA ,1989.

15UEE921	POWER SYSTEM DYNAMICS	L	T	P	C
		3	0	0	3

PREREQUISITE: 15UEE502 – POWER SYSTEM ANALYSIS

OBJECTIVES:

- To explain the modeling of synchronous machine, the excitation system and speed governing controllers
- To impart knowledge on the small signal stability analysis of a single-machine infinite bus system with excitation system and power system stabilizer
- To discuss the transient stability simulation of multi-machine power system

UNIT I INTRODUCTION **9**

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING **9**

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III EXCITATION SYSTEM MODELING **9**

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY **9**

State equation for multimachine system with one axis model and simulation – modelling of multimachine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient

stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact – linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals – dynamic performance measure - small signal performance measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Analyze the importance of power system stability in transient and dynamic behavior. [Analyze]
- Compute transient parameters from synchronous machine mathematical model. [Apply]
- Discuss the controlling of excitation and speed governing system. [Understand]
- Compute the transient stability analysis of multimachine power system. [Apply]
- Illustrate the dynamic performance measure of small signal stability. [Understand]

TEXT BOOKS:

1. P. M. Anderson and A. A. Fouad, ”Power System Control and Stability”, Galgotia Publications, New Delhi, 2003.
2. Kundur P., “Power System Stability and Control”, McGraw Hill Inc., USA, 1994.

REFERENCE BOOKS:

1. Pai M.A. and Sauer W., “Power System Dynamics and Stability”, Pearson Education Asia, India, 2002.
2. James A. Momoh and Mohamed. E. EI-Hawary, “Electric Systems, Dynamics and stability with Artificial Intelligence applications”, Marcel Dekker, New York, USA, First Edition, 2000
3. Padiyar K.R, “Power System Dynamics Stability & Control”, BS Publications, Hyderabad, 2002
4. Jan Machowski, Janusz W.Bialek and James R. Bumby, “Power System Dynamics : Stability & Control” ,Wiley,2008.

15UEE922 DEREGULATION AND RESTRUCTURED POWER SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To enable the students understand the operation of restructured power system, issues and technical challenges related to restructuring

UNIT I DEREGULATION OF ELECTRIC SUPPLY INDUSTRY 9

Introduction about deregulation – Structure of restructured electric utility – Different entities – Deregulation situation around the world – Benefits from competitive electricity market – After effects of deregulation. Role of Load Managers.

UNIT II POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT 9

Role of ISO – Comparison of two different market structures –Operational planning activities of ISO – ISO in bilateral markets –Operational planning activities of GENCO – GENCO in pool and bilateral markets – Market participation issues – Competitive bidding

UNIT III TRANSMISSION OPEN ACCESS AND PRICING ISSUES 9

Power wheeling – Types of transmission services in open access – Cost components in transmission – Pricing of power transactions – Pricing mechanisms in various countries – Congestion management in deregulation.

UNIT IV ANCILLARY SERVICES MANAGEMENT 8

General description of some ancillary services – Ancillary service management in various countries – Reactive power as an ancillary service – Synchronous generators as ancillary service providers.

UNIT V TECHNICAL CHALLENGES AND AVAILABILITY BASED TARIFF 10

Total Transfer Capability – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC –Concept of Congestion Management – Bid, Zonal and Node Congestion Principles - Generation Rescheduling. Availability based tariff – Necessity – Working Mechanism – Beneficiaries – Day Scheduling Process – Deviation from Schedule – Unscheduled Interchange Rate – System Marginal Rate – Trading Surplus Generation – Applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Explain the deregulation of electric supply industry. [Understand]
- Analyze the power system operation in competitive environment. [Analyze]
- Explain the fundamental concepts of congestion management. [Understand]
- Analyze the concepts of pricing of power transactions. [Analyze]
- Describe the ancillary services management and technical challenges. [Understand]

TEXTBOOKS:

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, “Operation of Restructured Power Systems”, Kluwer Academic Publishers, 2001
2. Loi Lei Lai, “Power system Restructuring and Regulation”, John Wiley sons, 2001.

REFERENCE BOOKS:

1. Shahidehpour.M and Alomoush.M, “Restructuring Electrical Power Systems”, Marcel Decker Inc., 2001.
2. G.Zaccour, “Deregulation of Electric Utilities”, Kluwer Academic Publishers 1998.
3. M.Illic, F.Galiana and L.Fink, “Power Systems Restructuring: Engineering and Economics”, Kluwer Academic Publishers, 2000.

WEB REFERENCES:

1. www.pjm.com
2. www.caiso.com
3. www.midwestiso.com

15UEE923	SMART GRID TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To summarize the power quality issues in smart grid.
- To familiarize the high performance computing for smart grid applications.

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V **HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS** **9**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and Cloud Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Differentiate conventional & Smart Grid. [Understand]
- Summarize the main issues with successful integration of smart grid technologies. [Understand]
- Identify successful applications and operations of HVDC and FACTS. [Understand]
- Evaluate power quality and EMC issues in smart grid. [Evaluate]
- Explain about high performance computing for smart grid applications. [Understand]

REFERENCE BOOKS:

1 Stuart Borlase, " Smart Grids :Infrastructure, Technology and Solutions ", CRC Press, 2012.

2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley publication, First Edition, 2012.

3 Vehbi C,Güngör, Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P.Hancke, "Smart Grid Technologies: Communication Technologies and Standards ", IEEE Transactions on Industrial Informatics, Vol. 7, No. 4, November 2011.

4 Xi Fang, Satyajayant Misra, Guoliang Xue and Dejun Yang, "Smart Grid – The New and Improved Power Grid: A Survey", IEEE communications surveys and tutorials, Transaction Vol.14, No. 4, Fourth Quarter, 2012.

15UEE924	ENERGY AUDIT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize energy scenario , energy audit ,energy conservation and refrigeration and air Conditioning
- To explain energy audit instruments.

UNIT I ENERGY SCENARIO 9

Role of Energy Managers in Industries – Energy monitoring, auditing & targeting – Economics of various Energy Conservation schemes. Total Energy Systems

UNIT II ENERGY AUDIT IN STEAM SYSTEMS 9

Various Energy Conservation Measures in Steam-- Energy Conservation in Steam Systems -Case studies.

UNIT III ENERGY CONSERVATION 9

Energy conservation in Centrifugal pumps, Fans &Blowers, Air compressor – energy consumption & energy saving potentials – Design consideration.

UNIT IV REFRIGERATION & AIR CONDITIONING 9

Heat load estimation -Energy conservation in cooling towers & spray ponds – Case studies
Electrical Energy -Energy Efficiency in Lighting – Case studies.

UNIT V ENERGY ANALYSIS AND CONTROL 9

Organizational background desired for energy management motivation, detailed process of M&T-Thermostats, Boiler controls -Losses in Boiler- proportional, differential and integral control, optimizers; compensators.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Summarise the role of energy manager and importance of energy audit. [Understand]
- Recommend a suitable energy conservation measures for a given steam system. [Evaluate]
- Recommend a suitable energy conservation measures for given equipment. [Evaluate]
- Recommend a suitable energy conservation measures for a given heating & cooling systems and lighting schemes. [Evaluate]
- Illustrate various energy control techniques in Boilers. [Understand]

TEXT BOOKS:

1. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists, Logman Scientific & Technical, ISBN-0-582-03184, 1990.
2. Reay D.A, Industrial Energy Conservation, 1stedition, Pergamon Press, 1977.

REFERNECES:

1. Larry C Whitetal, Industrial Energy Management & Utilization.
2.Power System Engineering 2nd Ed. D P Kothari, I J Nagrath, Tata McGraw-Hill Co 2008.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2					2	2	3	2					
CO.2	3	3				3	3	3				2		
CO.3	3	3				3	3	3				2		
CO.4	3	3				3	3	3	2			2		
CO.5	2					2	2	2						

15UEE925 ERECTION, TESTING AND COMMISSIONING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on installation, commissioning and testing of transformers, Synchronous machines, Induction machines and switch gear and protection devices

UNIT I INSTALLATION OF TRANSFORMERS 9

Power and distribution transformers as per BIS standards- Location, site, selection, foundation details (like bolts size, their number, etc), code of practice for terminal plates, polarity & phase sequence, oil tanks, drying of windings and general inspection.

UNIT II COMMISSIONING AND TESTING OF TRANSFORMERS 9

Commissioning - Volt ratio test, earth resistance, oil strength, Bucholz & other relays, tap changing gear, fans & pumps, insulation test, impulse test, polarizing index, load & temperature rise test.

Testing - Determination of performance curves like efficiency, regulation etc, and determination of mechanical stress under normal & abnormal conditions.

UNIT III INSTALLATION, COMMISSIONING AND TESTING OF SYNCHRONOUS MACHINES 9

Installation: Physical inspection, foundation details, alignments, excitation systems, cooling and control gear, drying out.

Commissioning Tests: Insulation, Resistance measurement of armature & field windings, waveform & telephone interference tests, line charging capacitance.

Performance tests: Various tests to estimate the performance of generator operations, slip test, maximum lagging current, maximum reluctance power tests, sudden short circuit tests, transient & sub transient parameters, temperature rise test, and retardation tests.

UNIT IV INSTALLATION, COMMISSIONING AND TESTING OF INDUCTION MOTORS 9

Installation: Location of the motors (including the foundation details) & its control apparatus, shaft & alignment for various coupling, fitting of pulleys & coupling, drying of windings.

Commissioning Test: Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations & balancing.

Electrical Tests: Insulation test, earth resistance, high voltage test, starting up, failure to speed up to take the load, type of test, routine test.

UNIT V SWITCH GEAR & PROTECTIVE DEVICES 9

Standards, types of protective devices, specifications, installation, various test on commissioning, maintenance schedule, type & routine tests.

TOTAL:45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Apply standards and code of practice for the installation of transformers. [Apply]
- Apply routine test procedures for proper commissioning of transformers and determine its performance. [Apply]
- Apply the procedures for installation, commissioning and testing of synchronous machines. [Apply]
- Apply the procedures for installation, commissioning and testing of induction motors. [Apply]
- Apply the procedures and standards for installation, commissioning and testing of switch gear & protective devices. [Apply]

TEXT BOOKS:

1. Testing & Commissioning Of Electrical Equipment -S. Rao,Khanna Publishers,2004
2. Testing & Commissioning Of Electrical Equipment -B .V. S. Rao, Media Promoters and Publication Pvt., Ltd.

REFERENCE BOOKS:

1. Relevant Bureau of Indian Standards
2. A Handbook on Operation and Maintenance of Transformers- H. N. S. Gowda, Published by H. N. S. Gowda,2006
3. Handbook of SwitchGears,BHEL, TMH,2005.
4. J and P Transformer Book, Elsevier Publication.

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	3					3	2	3				2		
CO.2	3	2				3	2	3				2		
CO.3	3					3	2	3				2		
CO.4	3					3	2	3				3		
CO.5	3					3		3				2		

15UEE926	PLC AND SCADA APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- PLC architecture and its components
- Ladder logic diagrams for given applications using basic and advanced Instructions
- SCADA architecture operation and applications

UNIT I PROGRAMMABLE LOGIC CONTROLLER (PLC) BASICS 9

Definition – Overview of PLC systems – Input and 0utput modules – Power supplies – Isolators – General PLC programming procedures – Programming on-off outputs – Auxiliary commands and functions – Creating ladder diagrams from process control descriptions – Register basics – Timer functions – Counter functions.

UNIT II PLC INTERMEDIATE AND ADVANCED FUNCTIONS 9

Arithmetic functions – Number comparison functions – Skip and MCR functions – Data move systems – PLC advanced intermediate functions – Utilizing digital bits – Sequencer functions – Matrix functions – Alternate programming languages – Analog PLC operation – Networking of PLC – PID control of continuous processes – PLC installation – Troubleshooting and maintenance – Controlling a Robot.

UNIT III INTRODUCTION TO SCADA AND ITS SYSTEM COMPONENTS 9

SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

UNIT IV SCADA ARCHITECTURE, OPERATION AND CONTROL OF INTERCONNECTED POWER SYSTEM 9

Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems. Automatic substation control, SCADA configuration, Energy management system, system operating states, system security,state estimation.

UNIT V PLC AND SCADA APPLICATIONS 9

PLC based speed control applications, SCADA Applications in transmission and distribution sector operation, monitoring analysis and improvement.. Case studies, implementation, simulation exercises.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Illustrate the components and their functions of the PLC. [Understand]
- Create ladder logic diagrams using PLC for a given application. [Create]
- Explain the components and its operation of SCADA system. [Understand]
- Apply the knowledge of SCADA in power system operation and control. [Apply]
- Develop PLC and SCADA for real time applications. [Apply]

TEXT BOOKS:

1. John. W. Webb and Ronald A. Reis, " Programmable Logic Controllers – Principles and Applications ",Fifth Edition,2002.
2. Frank D. Petruzella, "Programmable Logic Controllers ",Fourth Edition,2011

REFERENCE BOOKS:

1. Krishna Kant, "Computer based Industrial Control", Prentice Hall of India, 5th Edition, 2009.
2. Curtis D.Johnson, "Process control InstrumentarionTechnology", Pearson Education, 2006.
3. Stuart A Boyer, "SCADA supervisory control and data acquisition", 4th Edition, 2009.
4. Gordan Clark and Deem Reynders, "Practical Modem SCADA Protocols", 2004

CO – PO MAPPING

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO.1	2													
CO.2	3	3	3		2							2		
CO.3	2													
CO.4	3					2		3				2		
CO.5	3	2	2		2									

15UEE927	POWER PLANT INSTRUMENTATION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Explain the operation of nuclear power plant.
- To understand the various instruments available for monitoring/controlling power plant.
- To provide an overview of power generation through various methods.

UNIT I OVERVIEW OF POWER GENERATION 8

Various sources of electrical energy-Non-conventional and conventional energy sources-Importance of instrumentation and control in power plants-Building block of thermal power plant - Details of boiler processes - P&I diagram of boiler - Cogeneration.

UNIT II PARAMETERS OF POWER PLANTS AND ITS MEASUREMENT 10

Measurement of feed water flow, air flow, steam flow and coal flow -Measurement steam temperature & steam pressure - Drum level measurement -Radiations detector - Smoke density measurement -Dust monitor - Speed vibration, shell temperature monitoring & control - Flue gas analyzer - Fuel composition analyzer.

UNIT III BOILER CONTROL 7

Air/fuel ratio control- Burners for liquid and solid fuels - Burner management - Furnace safety interlocks -Firing rate demand - Steam temperature control - Control of deaerator -Furnace draft control - Flue gas dew point control - Trimming of combustion air - Soot blowing.

UNIT IV CONTROL OF TURBINE 9

Types of steam turbines - Impulse and reaction turbines- Turbine governing system- Speed and load control-Transient speed rise- Free governor mode operation -Automatic load Frequency Control - Turbine oil system - Oil pressure drop relay - Oil cooling system -Turbine run up system.

UNIT V NUCLEAR POWER PLANT INSTRUMENTATION 11

Introduction-Types of nuclear power plant-Sensors for nuclear power plants-Nuclear reactor control systems-Radiation detection and monitoring-Nuclear reactor safety. For further reading Digital Command Control (DCC)-Supervisory Control and Data Acquisition(SCADA)-Distributed Control System(DCS) .

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Recall the various methods of power generation. [Understand]
- Understand the instrumentation systems and their application to power plants. [Understand]
- Outline the boiler control methods of various plants. [Understand]
- Summarize the steam turbines, control and maintenance in power plants. [Understand]
- Illustrate the structure and process of nuclear power plant. [Understand]

REFERENCE BOOKS:

1. Everett Woodruff, Herbert Lammers, Thomas Lammers, Steam Plant Operation,9th Edition McGraw Hill, 2012.
2. Rajput R.K., A Text book of Power plant Engineering, 5th Edition, Lakshmi Publications, 2013.
3. P.K.Nag, Power plant Engineering, Tata McGraw-Hill Education, 3rd edition, 2007.
4. Sam Dukelow, Control of Boilers, Instrument Society of America, 1991. Krishnaswamy.K and
5. Ponnibala.M.,Power Plant Instrumentation?, PHI Learning Pvt. Ltd., New Delhi, 2011.
6. Elonka. S.M, and Kohan. A.L, Standard Boilers Operations, McGraw Hill, New Delhi, 2013
7. Jain. R.K, Mechanical and industrial Measurements, Khana Publishers, New Delhi, 2011.

15UEC954	PRINCIPLES OF COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamentals of analog and digital communication
- To provide the knowledge of various coding techniques for data transmission
- To impart the knowledge of satellite and optical fiber communication

UNIT I ANALOG COMMUNICATION 10

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB,DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Armstrong method & Reactance modulations :FM & PM frequency.

UNIT II DIGITAL COMMUNICATION 10

Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding : PCM, DM, ADM, DPCM,Modulation schemes– ASK, FSK,PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL CODES 9

Primary communication – entropy, properties, BSC, BEC, source coding: Shannon- Fano, Huffman coding: noiseless coding theorem, BW – SNR trade off ,line codes: NRZ, RZ, AMI, HDBP, ABQ, MBnB codes: Efficiency of transmissions, error control codes and applications: convolutional & block codes

UNIT IV MULTIPLE ACCESS TECHNIQUES 8

SS&MA techniques: FDMA, TDMA, CDMA, SDMA application in wire and wireless Communication: Advantages

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA 8

Orbits: types of satellites: frequency used link establishment, MA techniques used in satellite Communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Compare different kind of analog and digital modulation techniques in terms of generation demodulation , power and bandwidth requirement. [Understand]
- Summarize various digital modulation techniques [Understand]
- Develop different types of error control codes [Apply]
- Outline multiple access techniques. [Understand]
- Explain the techniques used in satellite and optical fiber communication. [Understand]

TEXT BOOKS:

1. Taub, Schiling, "Principles of communication systems" , Tata McGraw hill, 2007.
2. Das.J, Mullick,s.k.chatterjee P.k, , "Principles of digital communication" , New Age International , 2012.

REFERENCE BOOKS:

1. Kennedy, Davis," "Electronic communication systems", Tata McGraw hill, 4th Edition, 1993.
2. Bernard Sklar, "Digital communication fundamentals and applications", Pearson Education, 2001.
3. Barry,John R, Lee, Edward A.,Messerschmitt, "Digital Communication ", Kluwer Publication, 2004.
4. Amitabha Bhattacharya, "Digital Communication", Tata McGraw hill, 2006.

15UCS955	DATA STRUCTURES AND ALGORITHM ANALYSIS IN C	L	T	P	C
		3	0	0	3

PRE-REQUISITE: 15UCS107 - COMPUTER PROGRAMMING

UNIT I LINEAR DATA STRUCTURES 9

Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – Singly and doubly linked lists – applications of lists – Stack ADT – Queue ADT – Applications of stacks and queues

UNIT II TREE STRUCTURES 9

Need for non-linear structures – Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT.

UNIT III BALANCED SEARCH TREES AND INDEXING 9

AVL trees – Binary Heaps – B-Tree – Hashing – Separate chaining – open addressing – Linear probing.

UNIT IV GRAPH STRUCTURES 9

Introduction-Terminologies-Representations-Traversals-Applications-Dijkstra'sSingle source shortest Path Problem – Topological Sort-Minimum Spanning Trees.

UNIT V ALGORITHM DESIGN AND ANALYSIS 9

Greedy algorithms – Divide and conquer – Dynamic programming – backtracking – branch and bound – Randomized algorithms – algorithm analysis – asymptotic notations – recurrences – NP-complete problems.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Employ suitable linear data structures to organize the data. [Apply]
- Organize hierarchical data into binary tree. [Understand]
- Use hash technique for indexing. [Understand]
- Apply graph algorithms to solve real world problems. [Apply]
- Analyze the time complexity of an algorithm. [Analyze]

TEXT BOOKS:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition,Pearson Education,2009.
2. ISRD Group, “Data Structures using C”, 2nd Edition, McGrraw-Hill Education (India) Private Limited, 2013.

REFERENCE BOOKS:

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
2. R. F. Gilberg, B. A. Forouzan, “Data Structures: A Pseudocode approach with C”, Second Edition, Thomson India Edition, 2005.
3. Sara Baase and A. Van Gelder, “Computer Algorithms”, Third Edition, Pearson Education, 2000.
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd, 2001.
5. AnanyLevitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition,Pearson Education, 2012.

15UPH951	FUNDAMENTALS OF NANO SCIENCE	L	T	P	C
	(For EEE)	3	0	0	3

OBJECTIVES:

- To introduce the basics of Nanomaterials.
- To explain the synthesis methods of Nanopowders.
- To give an idea about Nanophase materials.
- To give knowledge about the Nanoscale properties.
- To familiarize the applications of Nanotechnology in Electrical and electronics Industry**.**

UNIT I NANODIMENSIONAL MATERIALS 9

Introduction to Nanotechnology: Characteristic scale for quantum phenomena, nanoparticles, nano-clusters, nanotubes, nanowires and nanodots. **Electronic structure:** quantum dots, quantum wires and quantum wells, confinement of electrons energy quantization- Semiconductor nanocrystals, carbon nanotubes, quantum wells.

UNIT II SYNTHESIS OF NANO MATERIALS 9

Synthesis of metallic, semiconducting and oxide nanoparticles – homo and hetero-nucleation growth methods – template-based synthesis (electrochemical, electrophoretic, melt and solution, CVD) –

Gas Phase Synthesis of Nanopowders: – Vapor (or solution) – liquid – solid (VLS or SLS) growth – the need for Gas/vapor state processing – Main Stages of Gas Phase Synthesis – Applicability of the methods-DTA, TGA, DSC (Principle and Applications), Determination of thermo physical parameters.

UNIT III CHARACTERIZATION OF NANOPHASE MATERIALS 9

X-ray sources – wide angle, extended x-ray absorption technique – **Electron microscopy:** Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM and EDAX analysis, Scanning Tunneling Microscopy (STM), Atomic force Microscopy (AFM), UV-VIS-IR Spectrophotometers, Raman spectroscopy

UNIT IV NANOSCALE PROPERTIES 9

Magnetism:- Magnetic Moment in clusters/Nanoparticles – Magnetic Order – coercivity – Magnetocrystalline Anisotropy – thermal activation and Superparamagnetic effects –

Electronics and Optoelectronics:- Quantum Confinement of Superlattices and Quantum Wells – Dielectric Constant of Nanoscale materials

UNIT V NANOTECHNOLOGY IN ELECTRICAL AND ELECTRONICS INDUSTRY 9

Advantages of nano electrical and electronic devices –Electronic circuit chips – Lasers - Micro and Nano Electromechanical systems – Sensors, Actuators, Optical switches, Bio-MEMS – Batteries - Fuel cells and Photo-voltaic cells – Electric double layer capacitors – Lead-free solder – Nanoparticle coatings for electrical products .

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Discuss the fundamentals of Nanoparticles. [Understand]
- Explain the synthesis methods of Nanopowders. [Understand]
- List the properties of Nanoscale properties. [Understand]
- Summarize the characterization of Nano materials. [Understand]
- Outline the applications of nanotechnology. [Understand]

TEXT BOOKS :

1. “Introduction to NanoScience and NanoTechnology” K.K.Chattopadhyay, A.N.Banerjee,PHI learning private limited, New Delhi,2009.
2. “Textbook of Nanoscience and Nanotechnology”,Murty, B.S., Shankar, P., Raj, B., Rath, B.B., Murday, J.SPRINGER and Co-publication with Universities Press (India) Pvt. Ltd.2013, XII Edition.

REFERENCE BOOKS:

1. C. N. R. Rao, A. Muller, A. K. Cheetham, “The Chemistry of Nanomaterials Synthesis, Properties and Applications’, Volume 1, Wiley-VCH, Verlag GmbH, Germany (2004).
2. C. Bre´chignac P. Houdy M. Lahmani, “Nanomaterials and Nanochemistry”, Springer Berlin Heidelberg, Germany (2006).
3. Guozhong Cao, “ Nanostructures & Nanomaterials Synthesis, Properties G;Z: Applications”, World Scientific Publishing Private, Ltd., Singapore (2004).
4. Bharat Bhushan, “Springer Handbook of Nanotechnology”, Barnes & Noble (2004).

15UEE971	NON-CONVENTIONAL ENERGY RESOURCES AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain concept of various forms of renewable energy
- To introduce the division aspects and utilization of renewable energy sources for both domestics and industrial applications
- To discuss the environmental and cost economics using renewable energy sources

UNIT I INTRODUCTION **9**

World energy use – Reserves of energy resources – Environmental aspects of energy utilization – Renewable energy scenario in India – Potentials – Achievements – Applications.

UNIT II SOLAR ENERGY **9**

Solar thermal – Flat plate and concentrating collectors – Solar heating and cooling techniques – Solar desalination – Solar cooker – Solar thermal power plant – Solar photo voltaic conversion – Solar cells – PV applications.

UNIT III WIND ENERGY **9**

Wind data and energy estimation – Types of wind energy systems – Performance – Details of wind turbine generator – Safety and Environmental Aspects.

UNIT IV BIOMASS ENERGY **9**

Biomass direct combustion – Biomass gasifier – Biogas plant – Ethanol production –Bio diesel – Cogeneration –Biomass applications.

UNIT V OTHER RENEWABLE ENERGY SOURCES **9**

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Fuel cell systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the Environmental aspects of energy utilization and Renewable energy scenario. [Understand]
- Illustrate the various applications of solar energy. [Understand]
- Discuss the concepts of types and performance of wind energy systems. [Understand]
- Analyze the processes of biomass. [Analyze]
- Analyze the process of other possible renewable energy sources. [Analyze]

TEXT BOOKS:

1.Rai G.D., “Non Conventional Energy Sources”, Khanna Publishers,1999.

2.Khan B.H., “ Non Conventional Energy Resources”, Tata McGraw Hill Publishing Company Ltd., 2006.

REFERENCE BOOKS:

1. Godfrey Boyle, “ Renewable Energy, Power for a Sustainable Future ”, Oxford UniversiPress, 1996.
2. Twidell J.W. and Weir, “Renewable Energy Sources ”, EFN Spon Ltd, 1996
3. Tiwari, “ Solar Energy – Fundamentals Design, Modelling and applications”,Narosa Publishing House, 2002.
4. Freris L.L., “ Wind Energy Conversion systems ”, Prentice Hall, 1990.
5. Sukhatme S.P., “ Solar Energy ”, Tata McGraw Hill Publishing Company Ltd., 1997.

15UEE972	ELECTRIC AND HYBRID VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand working of different configurations of electric vehicles, and its components, hybrid vehicle configuration and performance analysis.

UNIT I ELECTRIC VEHICLES 9

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II BATTERY 9

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III DC & AC ELECTRICAL MACHINES 9

Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN 9

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V HYBRID ELECTRIC VEHICLES 9

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the concepts of Electrical vehicles. [Understand]
- Discuss the various parameters of battery. [Understand]
- Analyze the performance of DC and AC machines used for Electric and Hybrid Vehicles. [Analyze]
- Explain the concepts electrical vehicle drive system. [Understand]
- Analyze the performance of various hybrid Electric vehicles. [Analyze]

REFERENCES:

1. Iqbal Hussain, “Electric & Hybrid Vechicles – Design Fundamentals”, Second Edition, CRC Press, 2011.
2. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.
4. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2001

15UEE973	SOLAR POWER PLANTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain concept of various power cycles involved in the solar power plants
- To outline the variety of solar systems used to collect solar energy
- To summarize basic economics of solar power plants

UNIT I INTRODUCTION 8

Power Plant Scenario - Classification, Basic Principles and Features - Comparison and selection Criteria.

UNIT II SOLAR POWER CYCLES 9

Vapour cycles. Organic cycles. Combined cycles. Binary Cycles. Strilng and other cycles.

UNIT III SOLAR THERMAL POWER PLANTS 10

Colector, Receiver, Energy Transfer Power cycles - Tower, Trough and Dish Systems – Concentrating Dish Systems - Concentrating Linear Fresnel Reflectors - Combined and Binary Cycles – Solar Chimneys - Hybrid Systems.

UNIT IV SOLAR PV POWER PLANTS 10

National / International PV Power Programmes - Photovoltaic Power Systems - System Integration - Energy Storage - Power Electronics - Stand-Alone Systems - Grid-Connected Systems - Concentrating Photovoltaic (CPV) - Electrical Performance.

UNIT V ECONOMICS OF POWER PLANTS 8

Methods of fixing power tariff - Simple Methods to Calculate the Plant Economy - Life Cycle Cost - Payback Period - Economic Analysis for the Selection of Alternative Decisions and the future of the Power Plants.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Explain the operation and features of various power plants. [Understand]
- Analyze the various solar power cycles. [Analyze]
- Explain the various components and their functions used for solar thermal power plants. [Understand]
- Discuss the operation of standalone and Grid connected solar PV power plants. [Understand]
- Analyze the cost estimation and economic factors of power plants. [Analyze]

REFERENCEBOOKS

1. Dufie, J.A., and Beckman, W.A. Solar Energy Thermal Process, John Wiley and Sons, New York, 2006.
2. Kosuke Kurokawa (Ed.), Energy from the Desert – Feasibility of very large scale photovoltaic power generation systems, James and James 2003.
3. Sukhatme S.P., Solar Energy, Tata McGraw Hils P Co., 3rd Edition, 2008.
4. C.J. Winter, R.L. Sizman, L.L. Vant-Hul, Solar Power Plants, Springer- Verlag Berlin and Heidelberg GmbH & Co. K, 201.
5. Tomas Markvart, Solar electricity, John Wiley & Sons, 2003.
6. Jorg Schlaich, The solar chimney: Electricity from the sun, Edition Axel Menges, 2005.
7. John McBrewster , Frederic P. Miler, Agnes F. Vandome (Eds.) Renewable Energy Commercialization, Alphascript Publishing 2009.

15UEE974	MEMS	L	T	P	C
		3	0	0	3

OBJECTIVIES:

- To impart knowledge on the fundamental science and engineering relevant to fabrication of miniature size systems
- To explain the relationship between nano/microstructure, characterization, properties and processing and design of materials
- To discuss the possess knowledge of sensors and actuators

UNIT I INTRODUCTION **9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I **9**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micro magnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

UNIT III SENSORS AND ACTUATORS-II **9**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , coustic, Tactile and Flow sensors

UNIT IV MICROMACHINING **9**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micromachining processes – Structural and Sacrificial Materials – Acceleration of

sacrificial Etch – Striations and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Select appropriate materials for design and construction of micro electro mechanical system. [Apply]
- Describe the operation of electrostatic sensors and actuators. [Understand]
- Explain the operation of Piezo-resistive sensors and actuators. [Understand]
- Compare the various types of etching methods. [Understand]
- Distinguish the operating principles of polymer and optical MEMS. [Understand]

TEXT BOOKS:

1.Chang Liu, “Foundations of MEMS”, Pearson Education Inc., 2006.

2. Stephen Beeby and Graham Ensell, “ MEMS Mechanical sensors”, Artech House,INC,2004..

REFERENCE BOOKS:

1. NadimMaluf, “ An introduction to Micro electro mechanical system design”, Artech House, 2000.

2. Mohamed Gad-el-Hak, “ The MEMS Handbook”, CRC press Baco Raton, 2000

3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture”, Tata McGraw Hill, New Delhi, 2002.

4. Julian w. Gardner, Vijay k. varadan and Osama O. Awadelkarim, “ Micro sensors MEMS and smart devices”, John Wiley & son Ltd,2002

5.James J.Allen, “Micro electro mechanical system design”, CRC Press, 2005

15UEE975	PRINCIPLES OF ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on

- Historical development and Laws of robotics.
- Concept of various kinds of actuators, sensors and vision systems of robots.
- Robot programming and path planning.
- Recent advancement in Robotics.

UNIT I INTRODUCTION 9

Automation and Robotics, laws of robotics, Robot Definitions, Robotic Systems and Robot Anatomy – Link – Joint – manipulator – Wrist – End effector – Actuators – Sensors – Controller, Classification of robots.

UNIT II ROBOT ACTUATORS AND POWER TRANSMISSION SYSTEM 9

Robot drive mechanisms - Hydraulic and Pneumatic systems - Electric Drives – DC PMMC motor and Brushless DC Motor – Servomotor – Stepper Motor, Mechanical Transmission method – Gear Transmission – Belt Drive – Cables – Roller Chains, Rotary to Rotary motion conversion - rotary to linear motion conversion mechanisms – Rack and pinion drives, Variable Speed Arrangement, Robot end effectors - Types.

UNIT III ROBOT SENSORS AND VISION SYSTEM 9

Sensor Characteristics, Review of Sensors - Potentiometers – Encoders – LVDT — Resolvers - Tachogenerators – Strain Gauge sensors, Position Sensors, Velocity Sensors, Proximity Sensors, Touch sensors, Accelerometers - Gyroscope - Laser Range Finder - Force and torque sensors – Resistance sensor, Robot Vision systems: Block Diagram of Robot Vision System – Image Capture Cameras – vidicon and Solid state – Lighting technique and devices – Image representation – Image Segmentation - Feature extraction - Object Recognition.

UNIT IV ROBOT KINEMATICS 9

Rotation Matrix, Composition of Rotation matrices - Euler Angles - Homogeneous Transformations for the manipulator - The forward and inverse problem of manipulator kinematics - Motion generation - Manipulator dynamics - Jacobian in terms of D-H matrices – Controller architecture.

UNIT V ROBOT CONTROL AND APPLICATIONS 9

Path Planning – Point-To-Point Motion – Motion Through sequence of Points, Block Diagram of Robot control System, Motion Control – Computed Torque Control, Force Control – Indirect Force control.

Applications: Flexible Manufacturing Systems concept - Automatic feeding lines, automatic inspection – Material transfers: Machine loading and unloading - Processing operations - Assembly and inspection – Automatic welding Robot.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the Laws of Robotics. [Understand]
- Analyze the concept of various kinds of actuators and power transmission system. [Analyze]
- Explain various Robot sensors and vision system. [Understand]
- Analyze various Robot kinematics. [Analyze]
- Explain the Robot control and applications. [Understand]

TEXTBOOKS:

1. Mikell P Groover, Mitchel Weiss, Roger N Nagel, Nicholas G Odrey, Ashish Dutta, “Industrial Robotics: Technology, Programming, and Applications 2nd Edition”, Tata-Mcgraw Hill Publisher, 2012.
2. Ming Xie, “Fundamentals of Robotics Linking Perception To Action”, World Scientific Publishing Co. Pte. Ltd, Singapore, 2003.

15UEE976	APPLIED SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an introduction to the emerging area of intelligent control and optimization.
- To offer a basic knowledge on expert systems, fuzzy logic systems, artificial neural networks and optimization techniques.
- To afford hands on training in Matlab-Neural Network toolbox, Matlab - GA toolbox and Matlab fuzzy-logic toolbox.

UNIT I INTRODUCTION 9

Approaches to intelligent control, Architecture for intelligent control, Symbolic reasoning system, rule-based systems, the AI approach.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron, Back propagation algorithm, Hopfield network, Self-organizing network and Recurrent network, Neural Network based controller.

UNIT III GENETIC ALGORITHM AND OTHER OPTIMIZATION TECHNIQUES 9

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters, Solution of typical control problems using genetic algorithm. Concepts of tabu search, ant-colony and PSO.

UNIT IV FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning, Introduction to fuzzy logic modeling and control, Fuzzification, inferencing and defuzzification, Fuzzy knowledge and rule bases, Fuzzy modeling and control schemes for nonlinear systems, Self-organizing fuzzy logic control.

UNIT V APPLICATIONS 9

GA application to power system optimization problems: Economic Dispatch problem, Unit Commitment problem, Optimal Capacitor placement in distribution systems. Identification and control of linear and non-linear dynamic systems using Matlab-Neural Network toolbox, Optimization using Matlab - GA toolbox, Implementation of fuzzy logic controller using Matlab – fuzzy logic toolbox.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the Architecture of AI. [Understand]
- Analyze the concept of Artificial neural networks. [Analyze]
- Explain the Genetic algorithm and other optimization techniques. [Understand]
- Analyze Fuzzy Logic System. [Analyze]
- Explain the GA application to power system optimization problems. [Understand]

TEXTBOOKS:

1. Sivanandam S.N., Deepa S.N., “Principles of Soft Computing”, Wiley India Pvt. Ltd., Reprint 2012.
2. Kosko B., “Neural Networks And Fuzzy Systems”, Prentice-Hall of India Pvt. Ltd., 1994.
3. Donald A. Waterman, “A Guide to Expert Systems”, Addison-Wesley Publishers.

REFERENCE BOOKS:

1. Jacek.M.Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House, 1999.
2. Klir G.J., Folger T.A., “Fuzzy sets, uncertainty and Information”, Prentice-Hall of India Pvt. Ltd., 1993.
3. Zimmerman H.J., “Fuzzy set theory-and its Applications”, Kluwer Academic Publishers, 1994.
4. Driankov, Hellendroon, “Introduction to Fuzzy Control”, Narosa Publishers.
5. Goldberg D.E., “Genetic algorithms in Search, Optimization and Machine learning”, Addison Wesley, 1989.
6. Padhy N.P., “Artificial Intelligence and Intelligent System, Oxford University Press, 2005.

15UEE861	WIND FARM DEVELOPMENT AND OPERATION	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To impart knowledge on wind farm development and operatic

UNIT I INTRODUCTION 4

Introduction to Wind farm Development and Operation: General Principles and Basic Concepts, Techno economic feasibility considerations. Government and Private Utilities, Rules and regulations, Guidelines, Constraints.

UNIT II INSTALLATION AND COMMISSIONING OF WIND TURBINES 5

Land selection, Topography and Survey details, Micrositing and layouts: – Methods and procedures, selection of equipment, Transportation, installation and commissioning Local infrastructure and Power evacuation; Grid quality and reliability.

UNIT III OPERATION AND MAINTENANCE OF WECS 6

Wind electric conversion systems, Operation efficiency of wind turbine, and Preventive, and Breakdown and Predictive maintenances of WECS subsystems, Failure analysis, aging and rehabilitation. Effective operation of wind farms: Concept of central monitoring system, Modern developments and improvements, Systems and Practices followed in other countries. Estimation of energy production, capacity factor, capacity credit and energy credit. Offshore wind farm development and special considerations. Operation and supervision of wind farm.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to:

- Define the Rules and regulations for the selection of ideal location of WECS
- Explain the Methods and procedures for installation and commissioning of wind turbines
- Analyze the operation of WECS using various indices

REFERENCES:

1. www.windpower.dk
2. T. Burton, Handbook of Wind Energy, John Wiley and Sons

15UEE862	DESIGN OF TOWERS AND BLADES STRUCTURES	L	T	P	C
		1	0	0	1

:

OBJECTIVE:

- To impart knowledge on design of towers and blades structure

UNIT I INTRODUCTION **3**

Introduction to Loads: Extreme loads, fatigue loads, earthquake loads, characteristic loads, partial co-efficients, design loads. Types of Towers**:** Lattice, Tubular (self supporting the guyed) and concrete.

UNIT II STRUCTURAL DESIGN OF TOWERS / BLADES AND CHARACTERISTIC **6**

Characteristic material properties, design properties, partial co-efficients, comparison of loads and strength.Design of Lattice Towers**:** Design of members subjected to lateral and axial loads. Stress/strain calculations. Blades: Geometry, webs and spars, design loads, extreme and fatigue stress/strain calculations, materials, deflations.

UNIT III TYPES AND DESIGN OF CONNECTIONS **6**

Types of connections (welded and fastened), design of framed beam connection, seated beam connections, un stiffened, stiffened seat connections, continuous beam-to-beam connections, continuous beam-to-column connections. Blades: Geometry, webs and spars, design loads, extreme and fatigue stress/strain calculations, materials, deflations.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to:

- Explain the various types of towers and loads of wind turbine
- Design the structure of towers and blades for wind turbine
- Explain the types of connections of towers and blades

REFERENCES*:*

1. Saloman C. G., and Johnson J. E., " Steel Structures – Design and behavior" Harper and Row 1980

2. Dayarathnam p., "Design of Steel Structures", A. H. Wheeler, 1990

3. " Guidelines for Design of Wind Turbines" second edition, DNV- RISO, Denmark

15UEE863 WIND TURBINE BLADES FABRICATION TECHNOLOGY

L	T	P	C
1	0	0	1

OBJECTIVE:

- To impart knowledge on wind turbine blades fabrication technolog

UNIT I ENGINEERING MATERIALS FOR WIND TURBINE BLADES **3**

Basic Structural design of rotor blades. Materials of construction of Rotor Blades - composite materials and properties, Fibreglass and carbon fibre reinforcements, Technology of Polymer Matrices- Polyesters, vinyl esters and epoxies.

UNIT II FABRICATION OF WIND TURBINE BLADES **9**

Moulds and Tooling for the fabrication of rotor blades. Molding process of composite rotor blades for wind turbines: hand lay up process; resin transfer, resin injection and vacuum infusion process; Prepreg and vacuum bag process. Finishing and assembly aspects of rotor blades.

UNIT III TESTING OF WIND TURBINE BLADES **3**

Inspection and quality control methods. Repair and servicing of wind turbine blades.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to:

- Explain the various materials for wind turbine blades fabrication technology
- Explain the fabrication process of wind turbine blades
- Analyze the testing of wind turbine blades

REFERENCES*:*

1. Saloman C. G., and Johnson J. E., " Steel Structures – Design and behavior" Harper and Row 1980
2. Dayarathnam p., "Design of Steel Structures", A. H. Wheeler, 1990
3. " Guidelines for Design of Wind Turbines" second edition, DNV- RISO, Denmar

15UEE864	SOLAR PHOTOVOLTAIC TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To explain basics of solar photovoltaic systems.
- To know in depth of its types and design of various PV-interconnected systems

UNIT I PHOTOVOLTAIC BASICS **5**

Structure and working of Solar Cells - Types, Electrical properties and Behaviour of Solar Cells – Cell properties and design - PV Cell Interconnection and Module Fabrication - PV Modules and arrays -Basics of Load Estimation.

UNIT II STAND ALONE PV SYSTEMS **5**

Schematics, Components, Batteries, Charge Conditioners - Balance of system components for DC and/or AC Applications - Typical applications for lighting, water pumping etc.

UNIT III GRID CONNECTED PV SYSTEMS **5**

Schematics, Components, Charge Conditioners, Interface Components - Balance of system Components - PV System in Buildings.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to:

- Explain basics of solar photovoltaic systems.
- Analyze stand alone PV systems
- Explain grid connected PV systems

REFERENCES

1. CS Solanki: Solar Photovotaics – Fundamentals, Technologies and Applications, PHI Learning Pvt. Ltd., 2011.

2. Martin A. Green, Solar Cells Operating Principles, Technology, and System Applications Prentice-Hall, 2008.

3. Nelson, J The Physics of Solar Cells. Imperial College Press, 2003. Thomas Markvart, Solar Electricit, John Wiley and Sons, 2001.

4. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish (Editors), Applied Photovoltaics, Earthscan, 2008.
5. Michael Boxwell, The Solar Electricity Handbook, Code Green Publishing, UK, 2009.
6. Rik DeGunther, Solar Power Your Home for Dummies, Wiley Publishing Inc, 2008.
7. Photovoltaics: Design and Installation Manual, Published by Solar Energy International.

15UEE865	INDUSTRIAL SAFETY MEASURES	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To acquire knowledge on industrial safety measures

UNIT I FACTORIES ACT – 1948 **7**

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948

UNIT II ENVIRONMENT ACT – 1986 **8**

General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001-No Objection certificate from statutory authorities like pollution control board.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to:

- Explain various factories act
- .Analyze the various environment act

REFERENCES:

1. The Factories Act 1948, Madras Book Agency, Chennai, 2000

2. The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.

3. Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd., New Delhi.

4. Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.

5. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.

6. The Mines Act 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.

15UEE866	ECO PAINT APPLICATION TECHNOLOGY FOR AUTOMOBILE INDUSTRY	L	T	P	C
		1	0	0	1

OBJECTIVES

- To be familiar with the technical terms used in industry.
- To understand the various technologies used in industry.
- To know about the various software being used in Core sector.
- To realize the importance of basic subject knowledge.
- To know about the paint-shop technique used in the car bodies and in two wheelers.

UNIT I PROGRAM RELATED TO AUTOMOBILE INDUSTRY 5

Comprises of motors , sensors, actuators , PLC systems , Network concept, control concept - layout of all levels and the equipment arrangement-Importance of ASU, Oven, Cooling zone-Application of Robotics-Concept of Control Desks, Control panels and field isolators- importance of sensors and its major role-Concept of Humidifier, Dampers and actuators -Heat load calculation -Importance of redundancy and the simple solutions -Cable & cable tray routing, termination etc.

UNIT II DESIGN SOFTWARES USED IN INDUSTRIES 5

Designing software's and its major role in industries- Software related to Control panel design: Busbar system, Relays ,Contactors, MPCB arrangement and wiring - PLC systems & its types: PLC programming, Installation : Cable tray routing and cable calculation Software.

UNIT III VIRTUAL NETWORKING AND CONTROLLING IN AUTOMOBILE INDUSTRIES & ECO-EMOS 5

Latest technology and its implementation -Virtual control concepts and the application of ECO-EMOS –Techniques related to ECO-EMOS- basic knowledge required to learn this software-Paint and final assembly system-Environmental system-Industrial cleaning and automation solutions- Filtration and automation technology- Measurement, adjustment and testing technology.

TOTAL: 15 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to:

- Develop program related to automobile industry
- Design softwares used in industries
- Analyze virtual networking and controlling in automobile industries & eco-emos

REFERENCES:

https://www.edgefx.in/industrial-applications-of-programmable-logic-controller/

www.softbitonline.com/auto_cd5.html

www.durr-india.com/.../120625_Du_PFS_Eco_Paintshop_EN_low.pdf

15UEE867	ENERGY STORAGE SYSTEMS	L	T	P	C
		1	0	0	1

OBJECTIVES

- To impart knowledge on energy storage systems.

UNIT I INTRODUCTION **5**

Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications.

UNIT II ELECTRICAL ENERGY STORAGE **10**

Fundamental concept of batteries – measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide and modern batteries for example (i) zinc-Air (ii) Nickel Hydride, (iii) Lithium Battery.

TOTAL: 15 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to:

- Analyze electrical energy storage systems

REFERENCES:

1. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002.
2. Fuel cell systems Explained, James Larminie and Andrew Dicks, Wiley publications, 2003.
3. Electrochemical technologies for energy storage and conversion, Ru-shiliu, Leizhang, Xueliang Sun Wiley publications, 2012.

15UEE868	CONTROLLING AND MONITORING OF ELECTRICAL EQUIPMENTS USING MOBILE APPLICATIONS	L	T	P	C
		1	0	0	1

UNIT I MOBILE APPLICATION DEVELOPMENT PLATFORM (OS) / FRAMEWORK 5

Introduction to Mobile Computing – Introduction to Various Mobile Application Development Platforms – J2ME Development Environment –J2ME Architecture – Overview of J2ME SDK Basic Building Blocks – J2ME User Interface Components.

UNIT II DESIGN AND DEVELOPMENT OF MOBILE APPLICATION FOR ELECTRICAL EQUIPMENTS 5

Overview of modern Sensors for measuring electrical parameters voltage, current and frequency in built with ADC - Block Diagram of Micro-Controller – GSM Modem – J2ME User Interface(UI) Design - J2ME Connect to DataBase – Schematic for Voltage, current and Power measurement monitoring Mobile Application – Building simple sample J2ME Application.

UNIT III TESTING AND DEPLOYMENT OF MOBILE APPLICATION FOR ELECTRICAL EQUIPMENTS 5

Various J2ME Emulator Platforms – Different methods of Deployment of J2ME Application – Deployment procedure for simple Power Calculation Mobile Application from Voltage, Current and Powerfactor.

TOTAL: 15 PERIODS

TEXT BOOK

1. J2ME: The complete Reference, James Keogh, Tata McGrawHill.

REFERENCE BOOKS:

1. Enterprise J2ME: Developing Mobile Java Applications – Michael Juntao Yuan, Pearson Education, 2004.
2. Beginning Java ME platform, Ray Rischpater, Apress, 2009.
3. Beginning J2ME: From Novice to Professional, Third Edition, Sing Li, Jonathan B. Knudsen, Apress, 2005.
4. Kicking Butt with MIDP and MSA: Creating Great Mobile Applications, 1st edition, J.Knudsen, Pearson.

15UEE869	ELECTRICAL REWINDING LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

1. To rewind a single phase Induction motor used for water pump
2. To rewind a single phase Induction motor used for ceiling fan
3. To perform various test in a single phase induction motor after completion of rewinding

TOTAL: 15 PERIODS

MATERIALS RQUIRED:

Manual Rewinding machine

Copper coil

Tools

15UGM954 - SMART BUILDINGS

OFFERING DEPARTMENTS: EEE & CIVIL

UNIT I INTELLIGENT BUILDINGS **9**

Concept, Definition, intelligent Architecture and structure, evaluation of intelligent buildings, IB assessment criteria – intelligent homes

UNIT II ENERGY MANAGEMENT IN DESIGN **9**

Natural building design consideration - Energy efficient design strategies - Contextual factors - Longevity and process Assessment -Renewable energy sources and design- Advanced building Technologies - Smart buildings.

UNIT III ENERGY MANAGEMENT IN SERVICES **9**

Energy in building design - Energy efficient and environment friendly building – Thermal phenomena - thermal comfort - Indoor Air quality - passive heating and cooling systems - Energy Analysis - Active HVAC systems -Preliminary Investigation - Energy audit - Types of energy audit - Energy flow diagram - Energy consumption/ Unit production – Identification of wastage -Priority of conservative measures - Maintenance of management programme.

UNIT IV BUILDING ENERGY CONSERVATION TECHNOLOGIES **9**

Standards of energy efficiency in buildings. Trends in energy consumption. Energy audit: evaluation of energy performance of existing buildings, use of computer models, impact of people behaviour. Energy efficiency measures in buildings: approaches, materials and equipments, operating strategies, evaluation methods of energy savings. Optimum selection of energy sources. Air-to-air energy recovery.

UNIT V CONTROL SYSTEMS IN BUILDINGS **9**

Introduction to automatic control systems, control issues related to energy conservation, interior air quality and thermal comfort in buildings – Ventilation. Classification of HVAC control system: selection and size of sensors, actuators and controllers. Practical HVAC control system Designing and turning controllers – Building automation systems, design for security.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Describe the concepts and evaluation criteria for Intelligent buildings (Understand)
- Explain the energy efficient design strategies (Understand)
- Summarise the energy management techniques in various building services and perform energy audits. (Understand)
- Describe and suggest various energy efficiency measures in buildings. (Understand)
- Intricate the automatic control systems and Building automation systems (Understand)

TEXT BOOKS:

1. Jim Sinopoli, “Smart buildings”, Smart building publisher: 2006, ISBN 0978614402, 9780978614409
2. Nilesh Y. Jadhav, “Green and Smart Buildings”, Springer Singapore Publisher: 2016.

REFERENCES:

1. James Sinopoli, “Advanced Technology for Smart Buildings”, Artech House, 2016
2. James Kachadorian, “Passive Solar House: The Complete Guide to Heating and Cooling Your Home” Chelsea Green Publishing; Revised and expanded second edition,2006
3. James M. Sinopoli, Smart Buildings Systems for Architects, Owners and Builders Publisher Butterworth-Heinemann, 2009

15UGM955 – ELECTRIC VEHICLES

(OFFERING DEPARTMENTS: EEE & MECH)

UNIT I Hybrid and Electric Vehicles (HEV): History Overview and Modern Applications 9

Ground vehicles with mechanical powertrain and reasons for HEV development - HEV configurations and ground vehicle applications - . Advantages and challenges in HEV design

UNIT II Power Flow and Power Management Strategies in HEV 9

Mechanical power: generation, storage and transmission to the wheels - Electric power: generation, storage and conversion to mechanical power - Hydraulic power: generation, storage and conversion to mechanical power - Energy storage/conversion and thermodynamic relations

UNIT III Electric Drives & Power Electronics in Hybrid Electric Vehicles 9

DC-Brushed and brushless drives: principles of design, operation, math modeling and control - Shunt Drives - Series Drives - Compound Drives - Thermal analysis of electric drives in various vehicle applications. Rectifiers - Buck convertor - Voltage source inverter - Current source inverter - DC-DC convertor

UNIT IV Vehicle Dynamics Fundamentals for HEV Modeling and Wheel-Electric Drive, Suspension System Design 9

Various strategies for improving vehicle energy/fuel efficiency - Vehicle chassis mathematical model in various operation conditions (steady motion, acceleration, regenerating braking, coasting, moving up and down a hill) Gear trains in wheel-electric drives - Mechatronic design of wheel-electric drives - Suspension design for wheel-electric drives Wheel/Tire-terrain interactive dynamics - Inverse dynamics-based control.

UNIT V Batteries and Energy Storages 9

Battery characterization, math modeling and designs-. Battery sizing for various vehicle applications - Battery monitoring and charging control - Combination of batteries and ultra capacitors - Fuel cells: principles of operation, design, modeling - Fuel cell storage system - Strategy for controlling hybrid fuel cell system- Flywheel energy storage characterization - Hydraulic accumulator characterization.

TOTAL: 45 PERIODS

REFERENCE BOOKS:

1. Chris Mi.M, Abdul Mansoor and David Wenzhong Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives” Wiley, Jul 2011.
2. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2011.
3. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.
4. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.
5. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2001

15UGM956 **ELECTRICAL HAZARDS & SAFETY IN HOSPITALS**

(Interdisciplinary Course: EEE & BIOMED)

L	T	P	C
3	0	0	3

UNIT I: REVIEW OF BIO-POTENTIAL AND RECORDING **9**

Electrodes as bioelectric transducers : The electrode-electrolyte interface; Specification and selection criteria for electrodes; Surface, needle, implanted electrodes; Polarisable and non-polarisable electrodes; Practical considerations for optimum performance; Reduction of interference, grounding, safety.

UNIT II: ELECTRICAL STIMULATION AND ITS PARAMETERS **9**

Use in generating evoked potentials, and for therapeutic correction (ECT, pacemakers, defibrillation), Safety limits and precautions; Safety: Hazards associated with the use of electrical /electronic instruments; Provisions for safety; Clinical safety norms.

UNIT III: RADIATION HAZARDS & SAFETY **9**

Retorted Potentials and concepts of radiation, Radiation from a small current element. Radiation resistance: Introduction to Electromagnetic Interference and Electromagnetic compatibility, EMI coupling modes, Methods of eliminating interference, shielding, grounding, conducted EMI, EMI testing: emission testing, susceptibility testing.

UNIT IV: HOSPITAL SAFETY **9**

Security & Safety of Hospital -Property, Staff & Patients, Safety precautions, Factors Contributing to Medical Errors: Health Care Reimbursement, Health Care Failure Mode and Effect Analysis (HFMEA).

UNIT V: ELECTRICAL & FIRE SAFETY **9**

Sources of shocks, macro & micro shocks - Hazards, monitoring and interrupting the operation from leakage current - Elements of fire, causes of fire , Action to be taken in case of fire in a Hospital.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M.J. Aminoff , Electrodiagnosis in Clinical Neurology, 3rd edition, Churchill Livingstone, USA, 1992.
2. J.A. Delisa, H.J. Lee, E.M. Baran, K.S. Lai & N. Spielholz , Manual of Nerve Conduction and Clinical Electrophysiology, 3rd Edition, Academic Press, New York, 1993.
3. Joseph F Dyro “Clinical Engineering Handbook”, Elsevier Publishers, 2004.

REFERENCE BOOKS:

1. Sharon Myers “Patient Safety & Hospital Accreditation - A Model for Ensuring Success”, Springer Publishers, 2012.
2. Webster J.G and Albert M.Cook, Clinical Engg, Principles & Practices, Prentic Hall Inc., Engle wood Cliffs, New Jersy, 1979.
3. Cadick, Mary Capelli-Schellpfeffer, and Dennis K. Neitzel ; Electrical Safety Handbook by John 2005 , McGraw-Hill Professional; 3 edition