Regulations and Curriculum

for

B.Tech. Electrical and Electronics Engineering

2014-2015

PONDICHERRY UNIVERSITY

BACHELOR OF TECHNOLOGY PROGRAMME

(EIGHT SEMESTERS)

REGULATIONS

1. CONDITIONS FOR ADMISSION:

(a) Candidates for admission to the first semester of the eight semester B.Tech. Degree programme should be required to have passed:

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (a mere pass for OBC and SC/ST candidates)in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry/Biotechnology/Computer Science/Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the PondicherryUniversity as equivalent thereto.

(b) For Lateral entry in to third semester of the eight semester B.Tech programme:

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering /technology with a minimum of 60% marks (50% marks for OBCand a mere pass for SC/ST candidates) in aggregate in the subjectscovered from 3rd to final semester or a pass in any B.Sc.coursewith mathematics as one of the subjects of study with aminimum of 60% marks (50% marks for OBC and a mere passfor SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects. The list of diploma programsapproved for admission for each of the degree programs is given
In**Annexure A.**

2. AGE LIMIT:

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme, candidates shouldnot have completed 24 years as on 1st July of the academic year under consideration. In the case of SC/ST candidates, the age limit isrelaxable by 3 years for both the cases.

3. DURATION OF PROGRAMME:

The Bachelor of Technology degree programme shall extend over a period of 8consecutive semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examination.

4. ELIGIBILITY FOR THE AWARD OF DEGREE:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters

(4 academic years)/6 semesters (3 academic years for Lateral Entry candidates) in the faculty of engineering and has passed the prescribed examinations in all semesters.

5. BRANCHES OF STUDY:

Branch I - Civil Engineering
Branch II - Mechanical Engineering
Branch III - Electronics & Communication Engineering
Branch IV - Computer Science & Engineering
Branch V- Electrical & Electronics Engineering
Branch VI - Chemical Engineering
Branch VII - Electronics &Instrumentation Engineering
Branch VIII - Information Technology
Branch IX - Instrumentation & Control Engineering
Branch X - Biomedical Engineering

Or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. SUBJECTS OF STUDY:

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. EXAMINATIONS:

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November/December or April/May).

(a) Theory courses for which there is a written paper of 75 marks in the university examination.

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows:

5 marks for 95% and above
4 marks for 90% and above but below 95%
3 marks for 85% and above but below 90%
2 marks for 80% and above but below 85%
1 mark for 75% and above but below 80%

A minimum of three tests are to be conducted for every theory subject and, of them two best are to be considered for computation of internal assessment marks.

(b) Practical courses for which there is a university practical examination of 50 marks:
Every practical subject carries an internal assessment mark of 50 distributed asfollows:

(i) Regular laboratory exercises and records - 20 marks (ii) Internal practical test – 15 marks (iii) Internal viva-voce – 5 marks and (iv) Attendance – 10 marks.

The marks earmarked for attendance are to be awarded as follows:

10 marks for 95% and above
8 marks for 90% and above but below 95%
6 marks for 85% and above but below 90%
4 marks for 80% and above but below 85%
2 mark for 75% and above but below 80%

8. REQUIREMENT FOR APPEARING FOR UNIVERSITY EXAMINATION:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

(i) He/She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by the University along with a medical certificate obtained from a medical officer not below the rank of Assistant Director)

(ii) He/She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.

(iii) His/hers conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

9. PROCEDURE FOR COMPLETING THE COURSE:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. PASSING MINIMUM:

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared “Failed” in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.
(c) If a candidate has failed in more than two papers in the current university examination, his/her representation for revaluation will not be considered.
(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

The internal assessment marks obtained by the candidate shall be considered only in the first attempt for theory subjects alone. For the subsequent attempt, University examination marks will be made up to the total marks. Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.

11. AWARD OF LETTER GRADES:

The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

Range of Total marks	Letter grade	Grade Points
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	F	0
Incomplete	FA	

Note: ‘F’ denotes failure in the course. ‘FA’ denotes absent/detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

(a) The college in which the candidate has studied.

(b) The list of courses enrolled during the semester and the grades scored.

(c) The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.

(d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

$$GPA = (\text{Sum of } (C \times GP)/\text{Sum of } C)$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.

(e) The conversion of CGPA into percentage marks is as given below

$$\%Mark = (CGPA-0.5)*10$$

12. AWARD OF CLASS AND RANK:

(i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semester (six semester for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semester 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in FIRST CLASS with DISTINCTION.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in FIRST CLASS.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in SECOND CLASS.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1^{st} to 8^{th} semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1^{st} to 8^{th} semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

13. PROVISION FOR WITHDRAWAL:

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank.

14. DISCONTINUATION OF COURSE:

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years including of the period of discontinuance.

15. REVISION OF REGULATIONS AND CURRICULUM:

The University may from time to time revise, amend or change the regulations of curriculum and syllabus and when found necessary.

ANNEXURE-A

(Diploma programs for admission for B.Tech. Lateral Entry)

B.Tech courses in which admission is sought	**Diploma courses eligible for admission**
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology/Engineering Textile Engineering/Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Electronic and Instrumentation Engineering Instrumentation and Control Engineering Bio Medical Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and InstrumentationEngineering Instrumentation Engineering/Technology Electronics and Communication Engineering. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Chemical Engineering	Chemical Engineering Chemical Technology Petrochemical Technology Petroleum Engineering Ceramic Technology Plastic Engineering Paper & Pulp Technology Polymer Technology
Information Technology Computer Science & Engineering	Computer Science andEngineering Computer Technology Electrical andElectronics Engineering Electronics &CommunicationEngineering Electronics &InstrumentationEngineering InstrumentationEngineering/Technology

I SEMESTER

CodeNo.	Name ofthe Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
T101	Mathematics – I	3	1	-	4	25	75	100
T102	Physics	4	-	-	4	25	75	100
T103	Chemistry	4	-	-	4	25	75	100
T110	BasicCivilandMechanical	4	-	-	4	25	75	100
T111	Engineering Mechanics	3	1	-	4	25	75	100
T112	Communicative English	4	-	-	4	25	75	100
	Practical							
P104	Physics lab	-	-	3	2	50	50	100
P105	Chemistry lab	-	-	3	2	50	50	100
P106	Workshop Practice	-	-	3	2	50	50	100
	Total	**22**	**2**	**9**	**30**	**300**	**600**	**900**

II SEMESTER

CodeNo.	Name ofthe Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
T107	Mathematics – II	3	1	-	4	25	75	100
T108	Material Science	4	-	-	4	25	75	100
T109	Environmental Science	4	-	-	4	25	75	100
T104	Basic Electrical and Electronics Engineering	3	1	-	4	25	75	100
T105	Engineering Thermodynamics	3	1	-	4	25	75	100
T106	Computer Programming	3	1	-	4	25	75	100
	Practical							
P101	Computer Programming Laboratory	-	-	3	2	50	50	100
P102	Engineering Graphics	2	-	3	2	50	50	100
P103	Basic Electrical & Electronics Laboratory	-	-	3	2	50	50	100
P107	NSS / NCC *	-	-	-	-	-	-	-
	Total	**22**	**4**	**9**	**30**	**300**	**600**	**900**

* To be completed in I and II semesters, under Pass / Fail option only and not counted for CGPA calculation

III SEMESTER

CodeNo.	Name of the Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
MA T31	Mathematics – III	3	1	-	4	25	75	100
EE T32	Electric Circuit Analysis	3	1	-	4	25	75	100
EE T33	Electrical Machines – I	3	1	-	4	25	75	100
EE T34	Electronic Devices and Circuits	4	0	-	4	25	75	100
EE T35	ElectromagneticTheory	3	1	-	4	25	75	100
EE T36	Fluid and Thermal Machines	4	-	-	4	25	75	100
	Practical							
EE P31	Electrical MachinesLab-I	-	-	3	2	50	50	100
EE P32	ElectronicsLab –I	-	-	3	2	50	50	100
EE P33	Fluid and Thermal Machines Lab	-	-	3	2	50	50	100
	Total	**20**	**4**	**9**	**30**	**300**	**600**	**900**

IV SEMESTER

CodeNo.	Name of the Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
MA T41	Mathematics – IV	3	1	-	4	25	75	100
EE T42	Electrical Machines – II	3	1	-	4	25	75	100
EE T43	Electronic Circuits	3	1	-	4	25	75	100
EE T44	Linear Control Systems	3	1	-	4	25	75	100
EE T45	Pulse and Digital Circuits	4	-	-	4	25	75	100
EE T46	Object Oriented Programming	4	-	-	4	25	75	100
	Practical							
EE P41	Electrical Machine Lab – II	-	-	3	2	50	50	100
EE P42	Electronics Lab – II	-	-	3	2	50	50	100
EE P43	Object Oriented Programming Lab	-	-	3	2	50	50	100
SP P44	Physical Education*	-	-	-	-	-	-	-
	Total	**20**	**4**	**9**	**30**	**300**	**600**	**900**

* To be completed in III and IV semesters, under Pass / Fail option only and not counted for CGPA calculation.

V SEMESTER

CodeNo.	Name of the Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
EE T51	Communication Engineering	3	1	-	4	25	75	100
EE T52	Analog and Digital Integrated Circuits	3	1	-	4	25	75	100
EE T53	Transmission and Distribution	3	1	-	4	25	75	100
EE T54	Power Electronics	3	1	-	4	25	75	100
EE T55	Measurements and Instrumentation	4	-	-	4	25	75	100
EE T56	Elective – I	4	-	-	4	25	75	100
	Practical							
EE P51	Electronics Lab – III	-	-	3	2	50	50	100
EE P52	Measurements and Control Lab	-	-	3	2	50	50	100
HS P53	General Proficiency – I	-	-	3	1	100	-	100
	Total	**20**	**4**	**9**	**29**	**350**	**550**	**900**

VI SEMESTER

CodeNo.	Name of the Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
EE T61	Power System Analysis	3	1	-	4	25	75	100
EE T62	Utilization of Electrical Energy	4	-	-	4	25	75	100
EE T63	Microprocessors and Microcontrollers	3	1	-	4	25	75	100
EE T64	Electrical Machine Design	3	1	-	4	25	75	100
EE T65	Digital Signal Processing	3	1	-	4	25	75	100
EE T66	Elective - II	4	-	-	4	25	75	100
	Practical							
EE P61	Power Electronics Lab	-	-	3	2	50	50	100
EE P62	Micro Processor and Microcontroller Lab	-	-	3	2	50	50	100
HS P63	General Proficiency – II	-	-	3	1	100	-	100
	Total	**20**	**4**	**9**	**29**	**350**	**550**	**900**

VII SEMESTER

CodeNo.	Name of the Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
EE T71	Industrial Management	4	-	-	4	25	75	100
EE T72	Solid State Drives	3	1	-	4	25	75	100
EE T73	Power system operation and control	3	1	-	4	25	75	100
	Elective – III	4	-	-	4	25	75	100
	Elective – IV	4	-	-	4	25	75	100
	Practical							
EE P71	Power System Simulation Lab	-	-	3	2	50	50	100
EE PW7	Project Phase – I	-	-	6	4	100	-	100
EE P72	Seminar	-	-	2	1	100	-	100
EE P73	Training/Industrial Visit	-	-	-	1	100	-	100
	Total	**18**	**2**	**11**	**28**	**475**	**425**	**900**

VIII SEMESTER

CodeNo.	Name of the Subjects	Periods			Credits	Marks		
		L	**T**	**P**		**IA**	**UE**	**TM**
	Theory							
EE T81	Protection and Switchgear	3	1	-	4	25	75	100
	Elective – V	4	-	-	4	25	75	100
	Elective – VI	4	-	-	4	25	75	100
	Practical							
EE PW8	Project Phase –II	-	-	9	8	50	50	100
EE P81	Comprehensive Viva	-	-	3	1	100	-	100
EE P82	Professional Ethical Practice	-	-	2	1	100	-	100
	Total	**11**	**1**	**14**	**22**	**325**	**275**	**600**

LIST OF ELECTIVES

GROUP– A

(To be taken from V and VI semesters)

EE E01	Network Analysis and Synthesis
EE E02	Modern Control Systems
EE E03	Fuzzyand Neural Systems
EE E04	Energy Engineering
EE E05	Electrical Safety
EE E06	Special Electrical Machines
EE E07	Bio-Medical Instrumentation
EE E08	FACTS Controllers

GROUP– B

(To be taken from VII and VIII semesters)

EE E09	Digital System Design using VHDL
EE E10	High Voltage Engineering
EE E11	Power System Economics
EE E12	Renewable Energy sources
EE E13	Digital Control Systems
EE E14	Embedded Systems Design
EE E15	HVDC Transmission
EE E16	Power System Restructuring and Deregulation
EE E17	Optimization Techniques
EE E18	Power System Stability
EE E19	Smart Grid
EE E20	Advanced Insulation Systems

MAT31 MATHEMATICS III

Objective: To provide the concepts of functions of a complex variable, conformal mapping, complex integration, series expansion of complex functions, Harmonic analysisand Fourier series. To make the students understand and work out problems of constructing analytic functions, conformal mapping, bilinear transformation, contour integration and expanding functions into Fourier series including Harmonic analysis. On successful completion of the module students will be able to Understand the concepts of function of a complex variable and complex integrationand apply these ideas to solve problems occurring in the area of engineering and technology. Expand functions into Fourier series which are very much essential for application in engineering and technology.

UNIT I: FUNCTION OF A COMPLEX VARIABLE

Continuity, derivative and analytic functions – Necessary conditions– Cauchy-Riemann equations (Cartesian and polar form) and sufficient conditions (excluding proof) – Harmonic and orthogonal properties of analytic function– Construction of analytic functions.

UNIT II:

Conformal mapping – Simple and standard transformations like w= z+c, cz, z^2, e^z, sin z,cosh z and z+1/z –Bilinear transformation and cross ratio property (excluding Schwarz-Christoffel transformation).Taylor's and Laurent's theorem (without proof) – Series expansion ofcomplex valued functions –classification of singularities.

UNIT III: COMPLEX INTEGRATION

Cauchy's integral theorem and its application, Cauchy's integral formula and problems.Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma (statement only)– Application of residue theorem to evaluate real integrals – unit circle and semicircular contour (excluding poles on boundaries).

UNIT IV: FOURIER SERIES

Dirichlet's conditions – General Fourier series – Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

UNITV

Root Mean Square Value –Parseval's theorem on Fourier Coefficients. Complex form of Fourier series – Harmonic Analysis.

Total: 45 hours

TEXT BOOKS:

1. Veerarajan T., EngineeringMathematics for firstyear, Tata-McGraw Hill, 2010.

2.Venkataraman M.K., EngineeringMathematics,Vol.II&III, National PublishingCompany, Chennai, 2012.

REFERENCE BOOKS:

1. KandasamyP. et al, EngineeringMathematics,Vol.II&III, S. Chand&Co., New Delhi, 2012
2. BaliN. P and Manish Goyal, Text book of Engineering Mathematics, 3rd Edition,Laxmi Publications (p)Ltd., 2008.
3. Grewal B.S., Higher EngineeringMathematics, 40th Edition, KhannaPublishers, Delhi2007.
4. Erwin Kreyszig, Advanced EngineeringMathematics, 7Th Edition, Wiley India, (2007).

EE T32 ELECTRIC CIRCUIT ANALYSIS

Objective: This course is intended forengineering students to facilitate the student's development into electrical research and to introduce fundamental principles of circuit theory. It makes them familiar in applying circuit theorems to simplify and find solution stoelectrical circuits.This course makes them to analyze three phase circuits. Fundamentals of graph theory such as incidence matrix, reduced incidence matrix, tieset and cutset matrix are introduced. It also explains about the transient response of RL, RC and RLC circuits to DC and AC excitation.Concept of resonance is dealt in detail and the coupled circuits are analyzed. By the end of this course, the student will be able to have a good understanding of the basics of circuit theory and acquire engineering analytic techniques and skills.

UNIT I: CIRCUIT ANALYSIS AND NETWORK THEOREMS FOR DC CIRCUITS

Review - Loop and Nodal method for DC circuits. Theorems -Thevenin's, Norton's, Superposition,- Compensation - Tellegan's, Reciprocity, Maximum power transfer theorems - Millman's theorem– Applications to DC circuits.

UNIT II: CIRCUIT ANALYSIS AND NETWORK THEOREMS FOR AC CIRCUITS

Review-Loop and Nodal method for AC circuits. Theorems-Thevenin'sNorton's Superposition Compensation-Tellegan's-Reciprocity-Maximumpowertransfertheorems-Millman'stheorem– Applications to AC circuits.

UNIT III: THREE PHASE CIRCUITS AND NETWORK TOPOLOGY

Three phase circuits: Three phase balanced/unbalanced voltage sources–analysis of three phase 3-wire and 4-wire circuits with star and delta connected balanced&unbalanced loads.Basic concepts of graph theory: Graph-directed graph-branch chord-Tree for two port networks, incidence and reduced incidencematrices-applicationtonetworksolutions.Link current and tie set, tree branch voltage and cut set, dualityand dual networks.

UNIT IV: TRANSIENT ANALYSIS OF FIRST& SECOND ORDER CIRCUITS

Transient response of RL, RC and RLC circuits to DC and AC excitation - Natural and forced oscillations - Laplace transform application to transient conditions.

UNIT V: RESONANCE AND COUPLED CIRCUITS

Resonant circuits-series, parallel, series - parallel circuits-effect of variation of Q on resonance.
Relations between circuit parameters - Q, resonant frequency and bandwidth
Coupled circuits: mutual inductance – coefficient of coupling–dot convention–
analysis of simple coupled circuits - Inductively coupled circuits - single tuned and double tuned circuits.

Total : 45 hours

TEXT BOOKS

1. Hayt and Kemmerly,"Engineering circuit analysis", McGrawHill, 6th edition,2002.

2. T S KV IYER, "Theory and Problems in Circuit Analysis", TataMcGrawHill, 2nd edition 1999.

3.M.S.Sukhija and T.K.Nagsarkar "CircuitsandNetworks", Oxford University Press, 3rd edition 2012

REFERENCE BOOKS

1. Schaum series, "Circuit theory", McGrawHill, New Delhi,4th edition, 2005.

2. Charles K Alex and and Mathew N. O Sadiku, "Fundamental of Electric Circuits", 2nd edition, TMH, New Delhi, 2003.

3. S.N. Sivanandam, "Electric Circuit Analysis", Vikas Publishing House Pvt. Ltd., New Delhi, 2008.

4. A. Sudhakar and S.P.Shyammohan "Circuits and Networks Analysis and Synthesis", TMH, 10th edition 2005

EE T33 ELECTRICAL MACHINES – I

Objective: This course makes an engineering student to understand and evaluate the performance of power and distribution transformers. It also emphasizes the basic concepts of electromechanical energy conservation through energy and co-energy.This also introduces the working of energy conversion machines namely motor and generator and various methods to control its speed and makes the student to decide its applications based on the characteristics.

UNIT I: MAGNETIC CIRCUITS AND ELECTRO MECHANICAL ENERGY CONVERSION

Simple magnetic circuit calculations– B-H Relationship – Magnetically induced emf and force – AC operation of magnetic circuits – Hysteresis and Eddy current losses - Energy in magnetic system – Field energy and mechanical force – Energy conversion via electric field

UNIT II: DC GENERATOR

Elementary concepts of rotating machines – mmf of distributed winding - DC Generator-Construction – Lap and wave winding – emf equation-excitation and types of generators-Characteristics - armature reaction-methods of improving commutation-testingpower flow diagram-Applications

UNIT III: DC MOTOR

DC Motor-torque equation – types-back emf and voltage equations-characteristics- Starting-Speed control- testing-direct, indirect and regenerative tests-Power flow and efficiency- separation of losses-retardation test- Braking - DC machines dynamics – Applications

UNIT IV: TRANSFORMERS

Single phase transformers – Principle-Construction – No load operation – Ideal transformer-Vector diagram- no load and on load -Equivalent circuit – Parallel operation and load sharing of single-phase transformers – Testing – Losses — Efficiency, voltage regulation and all day efficiency-Applications

UNIT V: POLYPHASE TRANSFORMERS AND SPECIAL TRANSFORMERS

Auto-transformer- construction and saving in copper – Three phase transformers – Principle - Construction - Poly phase connections – Star, Zig, Open-delta, Scott connection, three-phase to single phase conversion – On load tap changing – variable frequency transformer – Voltage and Current Transformers – Audio frequency transformer.

Total : 45 hours

TEXT BOOKS

1. I.J. Nagrath and D.P. Kothari, “Electric machines” T.M.H. publishing Co.Ltd., New Delhi, 4th Edition, 2010.

2. B.L. Theraja, “Electrical Technology Vol.IIAC/DC Machines”, S. Chand, 2008

REFERENCE BOOKS

1.Battacharya S K, “Electrical Machines”, Technical Teachers Training institute”, 2nd edition.2003.

2.J.B.Gupta,”Theory and Performance of Electrical Machines”,J.K.Kataria& Sons, 13th edition,2004.

3.P.C.Sen,”Principles of Electric Machines and Power Electronics, Wiley Student Edition,2nd edition,2008.

4. M.N.Bandyopadhyay, “Electrical Machines, Theory and Practice”, PHI, 2007

EE T34 ELECTRONIC DEVICES AND CIRCUITS

Objective: The course on Electronic devices and circuits aims to introduce various electronic devices like diodes, transistors, FET, MOSFET, DIAC and Triac to students. Basic operation of these devices and their characteristic curves will be taught at length.The students will be introduced to basic applications like rectifier circuits, filters, voltage regulator and amplifier circuits.The course aims to provide the fundamental conceptsof electronics to students and prepares them comprehensively for electronic circuit analysis to be dealt in future.

UNIT - I: SEMICONDUCTOR THEORY AND PN DIODES:

Introduction to Semiconductor materials–atomic theory–energy band structure of insulators, conductors and semiconductors–intrinsic and extrinsic semiconductors–N-type and P-type semiconductors.

SEMICONDUCTOR DIODES:

Construction – forward and reverse bias operation – mathematical model of a PNdiode–Silicon versus Germanium diodes – Effects of temperature ondiodeoperation– Static and dynamic resistances–Diode equivalent models– Specification sheets–Transition and diffusion capacitances– Diode switching-reverse recovery time–Diode applications.

UNIT - II: BIPOLARJUNCTION TRANSISTORS

Construction and operation– NPN and PNP transistors– CB, CE and CC configurations– transistor characteristics and regions of operation–Specification sheet–Biasing of BJTs– operating point– stabilization of operating point–different biasing circuits and DCloadline characteristics –Bias compensation techniques–thermal stability and thermal runaway.

UNIT-III: FIELD EFFECT TRANSISTORS

Construction – drain and transfer characteristics – Shockley'sequation–comparison between JFET and BJT – MOSFET – depletion type and enhancement types – Biasing of FETs – biasing circuits.

UNIT-IV: POWER DEVICES

Introduction to power devices– SCR,SCS, GTO,Shockley diode-DIAC- TRIAC and UJT.

RECTIFIERS AND POWER SUPPLIES: Half-wave and full-wave rectifiers–ripple eduction using filter circuits– Shunt and series voltage regulators– Regulated powersupplies.

UNIT-V:SPECIAL TWO-TERMINAL DEVICES

Principle of operation of Schottky diode,Varactor diode,Zener diode,Tunnel diode and PIN Diodes.

OPTO ELECTRONIC DEVICES: Principle of operation and characteristics of Photo diodes, Phototransistors, Photoconductivecells, LEDs and LCDs,Opto-couplers, Solarcells and thermistors.

Total : 45 hours

TEXT BOOKS:

1. JacobMillmanandChristosC.Halkias,"ElectronicDevicesandCircuits",Tata-McGraw Hill, 2003.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall India, 2009.
3. David A Bell, "Electronic Devices and Circuits",PHI, 4th Edition, 2006.

REFERENCE BOOKS:

1. J. D. Ryder, "Electronic Fundamentals and Applications",PearsonEd., Canada1976.
2. Allen Mottershed, "Electronic Devices and Circuits: An Introduction", PHI Learning 2011.

EE T35 ELECTROMAGNETIC THEORY

Objective: The objective of this subject is to look back themathematical tools like coordinate systems andvector calculus to investigate the physics of electric and magnetic fields.This course also demonstrates the unification of electrostatic and magneto-static fields as a time varying electromagneticfields that lead to the development of Maxwell's equations and also explores the fundamental so wavepropagation in different mediums. At the end of this course thes tudent is able to explore the electrostatic applications and will be able to solve problems with medium of different boundaries. It also introduces them the applications of time varying field and wave propagation and thereby makes them competent in electric, magnetic and time varying fields.

UNIT I: ELECTROSTATIC FIELD

Introduction - Coulomb'slaw – Electric field intensity–electric fields due to point, line, surface and volume charge distributions – Electric flux density–Gauss law –Applications of Gauss'Law– Divergence – Maxwell's first equation Divergence theorem – Electric potential–Potential field-Potential gradient –Field due to dipoles– dipole moment– Energydensity.

UNIT II: ELECTRIC FIELDS IN MATERIAL SPACE

Current and current density–Continuity of current–Conductor properties and Nature of Dielectrics– Boundary conditions–Capacitance–Capacitance of system of conductors– Polarization in dielectrics – Dielectric constant and Dielectric strength - Energy stored in capacitor–method of images-Poisson's and Laplace equations–Electrostatic applicationsin Van de Graff generator, Electrostatic separation and Xerography.

UNIT III: STEADY MAGENTICFIELDS

Introduction–Biot-Savart Law–Ampere's Circuital Law–Applications–Curl and Stoke's theorem – Magnetic flux and Magnetic flux density – The Scalar and Vector magnetic potentials– Force on a moving charge and current elements– Force and Torque on closed circuit.

UNIT IV: MAGNETIC MATERIALS, CONCEPTS AND APPLICATIONS

Introduction to magnetic materials – Magnetization and Permeability–Magnetic boundary conditions – Magnetic circuit – Potential energy and forces on Magnetic materials – Inductance and mutual inductance – Inductance of solenoids, toroids, and transmission lines – Faraday'sLaw– Time varying magnetic field. Application of Magnetic field in Induction heating and Magneplane.

UNIT V: ELECTROMAGNETIC WAVEPROPAGATION

Conduction current and Displacement current – Maxwell's equation in point and integral forms– Wave propagation in free space– Wave propagation in Dielectrics – Power and the Poynting Vector – Propagation in good conductors. Application in Microwaves in Telecommunications, Radar systems and Micro wave heating.

Total : 45 hours

TEXT BOOKS:

1. William Hayt," Engineering Electromagnetics", McGraw Hill, New york, 7th edition, 2005.
2. Matthew N.O.Sadiku,"PrinciplesofElectromagnetics",Oxford University Press, New Delhi, 4th Edition, 2007.

REFERENCE BOOKS:

1. David K Cheng, "Field and Wave Electromagnetics",PearsonEducation, 2nd edition,2004.
2. John D. Kraus, "Electromagnetics" McGrawHill, 5th Edition,1999.
3. L.C.Shen,J.A.Kong and A Patnaik,"EngineeringElectromatnetics",CengageLearning India Pvt.Ltd, 2011.
4. N.Narayana Rao,"Elements of Engg. Electro Magnetics",Prentice Hall of India, 6rd Edition,2008.
5. T.V.S. Arun Murthy,"Electromagnetic Fields", S.Chand, 2008.

EE T36 FLUID AND THERMAL MACHINES (QUALITATIVE ANALYSIS ONLY)

Objective: The objective of the course is to introduce basic principles of fluid mechanics, measurement of parameters of fluids. It enables to learn about hydraulic machines like the hydraulic turbines which drive electricgenerators and the hydraulic pumps which are driven by electricmotors. This course enables the students to study about the major components and types of thermal power plants, internal combustion engines and gasturbine power plants. Besides it introduces steps to calculate the cycle efficiencies for the above mentioned powerplants. By the end of the course, thestudents will be able to calculate the fluid properties, fluidflowrates, comprehend the differences between various types of hydraulic machines, understand the operation ofvarious power plants and calculate their efficiency.

UNIT I: FLUID MECHANICS

Definition of fluid – viscosity – Newton's Law of viscosity–Pressure and its measurement:

Simple manometers–Application of Bernoulli's equation of flow measurement: venturimeter, orifice meter and pitottube– headloss due to friction in pipes–minorlosses: sudden expansion, sudden contraction and bends-pipes in series, pipes in parallel.

UNIT II: HYDRAULIC MACHINERY

Turbines: Head and efficiencies associated with turbines–Classification of turbines– Peltonwheel:partsandworkingprinciple–Francisturbine:parts and working principle–Specificspeed and its application.– unitquantities– governingof turbines. Pumps: Roto-dynamics and positive displacement pumps– centrifugal pumps:partsandworking principles–priming–cavitation–Specific speed–Reciprocating pump: main parts andworking principle – indicatordiagram– effect of acceleration and friction on indicator diagram– useair vessel – Gear pump.

UNIT III: STEAM POWER GENERATION

Properties of steam Steam powerplant: Components of steam power plant–Rankinecycle–Reheat cycle– calculation of efficiencies– Steamturbines: Impulse and reaction turbines –Compounding of impulse turbines– condensers and coolingtowers.

UNIT IV: INTERNAL COMBUSTION ENGINE AND AIRCONDITIONING

Components of SI and CI engines–testing of IC engines–fuel feed systems–ignition systems– cooling system–lubricating system–governing of IC engines–Air Conditioning: psychometric properties of air -summer and winter air conditioning – automobile air conditioning systems.

UNIT V: GAS TURBINES AND AIR COMPRESSORS

Gas turbine power plant: Components, cycle of operation and classification–effect of reheating on cycle efficiency – Methods of heat recovery from the exhaust of gas turbine – Air Compressors: Reciprocating air compressor–influence of clearance volume and intercooling on the cycle efficiency –Rotary Compressors: Comparison of fan, blower and compressor–features of centrifugal compressor – working of vane compressor and roots blower.

Total : 45 hours

TEXTBOOKS

1. Modi P N and Seth S M, Hydraulics and Fluid mechanics, Standard Publishing House, Delhi, 2007
2. Balaney P L, Thermal Engineering, Khanna Publishers, New Delhi, 2007

REFERENCEBOOKS

1. Rajput, R K."Fluid Mechanics and Hydraulic Machines",S.Chand & Company, New Delhi, 2002.
2. Nag, P.K.,“Engineering Thermodynamics”, 4th edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi,1995
3. Mathur M. L. and Sharma R. P “Internal Combustion Engines” Dhanpat Rai & Sons, New Delhi; 1992.

EE P31 ELECTRICAL MACHINESLAB - I

(A minimum of TEN experiments to be conducted in the following Topics)

Objective: The objective of the course I is to enable the students to realize the performance of single phase and threephase transformers under no load and load conditions. It enables the students to understand the intricacies in connecting the circuit and conducting the experiments. The students get familiarize with the load performance of different types of DC motors and generators and understand the predetermination methods for finding the losses and efficiencies of transformers and DC motors.

List of Experiments

DC MACHINES

1. Load test on DC shunt Motor
2. Load test on DC series Motor
3. Load test on DC Compound Motor
4. Open Circuit Characteristics of self-excited DC shunt Generator
5. Load test on self-excited DC shunt Generator
6. Open Circuit Characteristics of separately excited DC shunt Generator
7. Load test on separately excited DC shunt Generator
8. Load test on DC series Generator
9. Swinburne's Test
10. Hopkinson's test on DC Machines
11. Study on Retardation test and Speed control of DC Motors.

TRANSFORMERS

12. Load test on single phase transformer
13. O.C and S.C test on single phase transformer
14. Load test on three phase transformer
15. Parallel operation of single phase transformers
16. Sumpner's test on single phase transformers
17. Study of three phase transformer connections

EE P32 ELECTRONICS LAB - I

(A minimum of TEN experiments to be conducted in the following Topics)

Objective: The objective of the course is to enable the students to understand the volt-ampere characteristics of basic electron devices such as PN junctiondiode, zener diode, bipolar junction transistor, fieldeffect transistor, and silicon controlled rectifier. The students acquire knowledge about the design of biasing circuits of BJT and FET in order toapply them for realizing any electronic circuits. In addition,the students are introduced with some of the applications of these electron devices.

List of Experiments

1. Determination of V-I characteristics of PN Junction diode andZener diode.
2. Determination of input and output characteristics of a BJT in CE configuration.
3. Determination of input and output characteristics of a BJT in CBconfiguration.
4. Determination of drain and trans-conductance of a FET.
5. Determination of intrinsic stand-off ratio of an UJT.
6. Determination of switching characteristics of a SCR.
7. Determination of switching characteristics of a TRIAC in forward and reverse modes.
8. Design of diode clippers and clampers.
9. Studyof half wave and fullwave rectifiers with and without filters.
10. Design of series and shunt regulators using zener diodes.
11. Study and design of various transistor biasing circuits.
12. Study of operation of a CRO.

EE P33 FLUID AND THERMAL MACHINES LAB

Objective: This course is intended to enable the students to apply the knowledge acquired in the theory and to understand the performance of certain fluid and thermal machines which are coupled with electrical machines. It provides as trong foundation in experimental work for being able to design, organize and conduct an experiment, collect field data, calculate, interpret and analyze the results.At the endof the course, the students are able t ounderstand the performance characteristics of primemovers and thermal machines.

List of Experiments

1. Determination of co - efficient of discharge of venture-meter / orifice-meter.
2. Determination of friction factor and minor losses due to pipe implements.
3. Determination of force due to Impact of jet on vanes.
4. Performance characteristics of pumps (Centrifugal/Reciprocating/Submersible/Jet/Gear Pump).
5. Performance characteristics of Turbine (PeltonWheel/Francis Turbine).
6. Performance test of a Blower.
7. Performance test of a Reciprocating aircompressor.
8. Testing of IC engine with an AC generator loading.
9. Conducting an experiment on Cooling Tower / Refrigeration using test rig.

MA T41 MATHEMATICS – IV

Objective: Importance of problems in Partial Differential Equations Problem solving techniques of PDE. To make the students knowledgeable in the areas of Boundary Value Problems like vibrating string (wave equation), heat equation in one and two dimensions. To acquaint the students with the concepts of Theory of sampling. On successful completion of the module students will be able to Understand the different types of PDE and will be able to solve problems occurring in the area of engineering and technology. Know sampling theory and apply to solve practical problems in engineering and technology.

UNIT I : PARTIAL DIFFERENTIAL EQUATIONS

Formation by elimination of arbitrary constants and arbitrary functions – General, singular, particular and integrals – Lagrange's linear first order equation – Higher order differential equations with constant coefficients

UNIT II : SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solution – Transverse vibration of an elastic string.

UNIT III : HEAT FLOW EQUATIONS

Fourier series solution for one dimensional heat flow equation – Fourier series solutions for two dimensional heat flow equations under steady state condition – (Cartesian and Polar forms).

UNIT IV : APPLIED STATISTICS

Curve fitting by the method of least squares – fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large samples test for single proportions, differences of proportions, single mean, difference of means and standard deviations..

UNIT V : CORRELATIONS AND FITNESS

Small samples – Test for single mean, difference of means and correlations of coefficients, test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Total : 45 hours

TEXTBOOKS

1. M.K.Venkataraman,"Engineering Mathematics",Vol. II&III, National Publishing Co., Madras, 2007.
2. S.C. Gupta & V.K. Kapoor "Fundamentals of Mathematical Statistics", Sultan Chand Sons, New-Delhi, 2008.

REFERENCE BOOKS

1. Kandasamy P. et al, Engineering Mathematics, Vol. II & III, S. Chand & Co., New Delhi, 2012.
2. Grewal B.S., Higher Engineering Mathematics, 40th Edition, Khanna Publishers, Delhi 2007
3. Bali N.P., Manish Goyal, " Engineering Mathematics, 7th Edition, Laxmi Publications, 2007.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 7th Edition, Wiley India, 2007.
5. Ray Wylie C. , Advanced Engineering Mathematics, 6th Edition, Tata McGraw Hill, 2003

EE T42 ELECTRICAL MACHINES – II

Objective: The course aims to provide a complete understanding of the principle, performance of a three phase induction motor with evaluation of its characteristics and numerous applications. The subject nature also aims to give a detailed study on three phase synchronous machine, operation, principle, working nature both as generator and as motor. It also includes special characteristics and application.Besides,the course includes study of singlephase machines with some special machines and their characteristics and specific applications. At the end of thecourse, the students willbe able to understand the characteristics of different ac machines and their operation.

UNIT I: THREE PHASE INDUCTION MOTOR

AC windings – Establishment of magnetic poles – Rotating magnetic field - Three phase induction motor– Construction, types and operation –Torque equation – Mechanical characteristics effect of supply voltage and rotor resistance on torque. - Tests- derivation of exact equivalent circuit.

UNIT II: INDUCTION MOTOR STARTING AND SPEED CONTROL

Torque-Power relationships – Performance characteristics/calculations - Circle diagram – Starting methods– braking-Cogging and crawling – Speed control methods and influence on speed-torque curve– Double cage rotor – Induction generator – types – Induction machine dynamics – Synchronous induction Motor.

UNIT III: SYNCHRONOUS GENERATOR

Types, construction and principle of operation - emf equation- winding factor , effect of chording and winding distribution – armature reaction – Voltage regulation by synchronous impedance, MMF and Potier triangle methods - load characteristics – Parallel operation of synchronous generators, Synchronizing to infinite bus-bars- power transfer equations, capability curve- two reaction model of salient pole synchronous machines and power angle characteristics - determination of Xd & Xq by slip test- Short circuit transients in synchronous machines.

UNIT IV: SYNCHRONOUS MOTOR

Principle of operation, methods of starting, power flow, power developed by Synchronous motor, phasor diagrams – torque angle characteristics, effects of varying load and varying excitation, excitation and power circles for synchronous machine – ‘V’ and inverted ‘V’ curves – hunting – Synchronous phase modifier – Induction motor Vs Synchronous motor.

UNIT V: SINGLE PHASE AND SPECIAL MACHINES

Single phase induction motors – Rotating magnetic Vs alternating magnetic field - Double revolving field theory – Torque - speed characteristics – types – Reluctance motor– Two phase Servo motor–

Stepper motors – Universal motor- linear induction motor - permanent magnet DC motor.

Total : 45 hours

TEXT BOOKS

1. I.J. Nagrath and D.P. Kothari, “Electric machines” T.M.H. publishing Co.Ltd., New Delhi, 4th Edition, 2010.

2. B.L. Theraja, “Electrical Technology Vol.II AC/DC Machines”, S. Chand, 2008

REFERENCE BOOKS

1.Battacharya S K, “Electrical Machines”, Technical Teachers Training institute”, 2nd edition.2003.

2.J.B.Gupta,”Theory and Performance of Electrical Machines”, J.K.Kataria& Sons, 13th edition,2004.

3.P.C.Sen,”Principles of Electric Machines and Power Electronics, Wiley Student Edition,2nd edition,2008.

4. M.N.Bandyopadhyay, “Electrical Machines, Theory and Practice”, PHI, 2007

EE T43 ELECTRONIC CIRCUITS

Objective: The course objectives are to provide the students a complete understanding of transistor circuits, low frequency amplifier. It includes modeling of bi-polar junction transistor and field effect transistor. The course includes detailed analysis and design of amplifiers, multistage amplifiers, oscillators using BJT and FET and of power amplifiers. At the end of the course students,will be capable of analyzing and designing electronic circuits using BJT and FET.

UNIT I: SMALL SIGNAL AMPLIFIERS

Two port devices and hybrid model– transistor hybrid model and H-parameters – determination of H-parameters from transistor characteristics–Analysis of CB, CE and CC circuits using H-parametermodel–Comparison of CB, CE and CC circuits–CE amplifier with unbiased emitter resistance. Low frequency FET model– analysis of common sourceand common drain circuits.

UNIT II: MULTISTAGE AMPLIFIERS

Cascading amplifier–direct coupled and capacitor coupled two stage CE amplifiers–Darlington pair–Cascode amplifier–Tuned amplifier circuits–single tuned–double tuned–stagger tuned amplifiers.

UNIT III: LARGE SIGNAL AMPLIFIERS

Classification of Power amplifiers–Class A power amplifier–direct coupled and transformer coupled–Class B amplifier–push-pull arrangement and complementary symmetry amplifiers–Conversion efficiency calculations –cross-overdistortion–Class AB amplifier–Amplifier distortion – Power transistor heat sinking – Class Cand Class D amplifiers.

UNIT IV:FEEDBACK AMPLIFIERS

Feedback concept–Gain with feedback–General characteristics of negative feedback amplifiers–Four basic types of feedback and the effect on gain, input and output resistances. Multistage feedback amplifiers–Two stage CE amplifier with series voltage negative feedback – frequency response and stability.

UNIT V:OSCILLATORS

Conditions for sustained oscillations–Barkhausen criterion–LC oscillators–analysis of Hartley, Colpitt and Tuned oscillators–RC oscillators–Phase shift and Wein-bridge types–analysis of the circuits– Crystal oscillators and frequency stability–UJT relaxation oscillators.

Total : 45 hours

TEXT BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Prentice-Hall India, 2009.
2. David A Bell, “Electronic Devices and Circuits”, PHI, 4th Edition, 2006.

REFERENCES:

1. Jacob Millman andChristos C. Halkias,“Electronic Devices and Circuits”,Tata-McGraw Hill, 2003.

EE T44 LINEAR CONTROL SYSTEMS

Objective: The course on linear control systems introduces a comprehensive treatment of various facts, modeling, analysis and control of linear dynamic systems and also introduces two modeling approaches namely the transfer function and state space approach. One of the primary objectives of the course is to deal with methodologies for ascertaining various attributes of dynamic systems like controllability, observability and stability. The students will be able to analyse stability of systems using classical techniques like Routh-Hurwitz test, Bode plots and Nyquest techniques. At the end of the course, the students will be able to analyse, model and design controllers for linear dynamic systems.

UNIT I: INTRODUCTION

Introduction to Control systems – Classical control theory concepts–Mathematical modeling of physical systems–transfer function approach – concept of poles and zeros – Open and closed loop control systems – Simplification of complex systems using block diagram reduction technique and Mason's gain formula (signal flowgraphs).

UNIT II: TIME-RESPONSE ANALYSIS

Standard test signals–Transient analysis of first and second order systems using standard test signals–correlation between pole location in s-plane and time-response–time-response analysis specification – Steady state analysis– Error criteria and its importance.

UNIT III: ANALYSIS OF DYNAMIC SYSTEMS USING ROOT LOCUS AND FREQUENCY RESPONSE METHODS

Root locus concepts–construction of root loci–root contours–Frequency response analysis–introduction and its importance–correlation between frequency response and time-response analysis–frequency response specifications–Frequency response plots– Polar plot and Bode plot–Introduction to all-pass and minimum-phase systems.

UNIT IV: STABILITY OFDYNAMIC SYSTEMS

Concept of stability of LTI systems–Routh and Hurwitzstability criteria–relative stability analysis using Routh's stability criterion–Stability analysis in frequency domain–Nyquist stability criterion– Relative stability analysis using phase margin and gain margin specifications– Nichol's chart and its importance in design of systems for a specified phase margin and gain margin.

UNIT V: STATE-SPACE ANALYSIS OF LTI SYSTEMS

Introduction to state-variable approach to modeling of dynamic systems–physical variable, phase variable and canonical variable approaches–advantages of state variable approach over transfer function–derivation of transfer function from state space model- Solution to state equation–

homogenous system and forced system–state transition matrix and its properties– ascertaining stability from eigen values of system matrix–Introduction to controllability and observability concepts.

Total : 45 hours

TEXT BOOKS:

1. R. Ananda Natarajan and P. Ramesh Babu, "Control Systems Engineering", 4th Edition, SciTech Publications (India) Pvt. Limited, Chennai, 2013.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", 5thEdition, New Age International (P)Limited, New Delhi, 2007.
3. K. Ogata, "Modern Control Engineering", 4thEdition, Pearson Education,2004.

REFERENCES:

1. B. C. Kuo, "Automatic Control Systems", 8th Edition, Wiley Students Edition, 2008.
2. Norman S.Nise,"ControlSystemsEngineering",4th Edition, Wiley Students Edition, 2004.
3. D. K. Cheng, "Analysis of Linear Systems", Narosa Publishing House, New Delhi, 2002.

EE T45 PULSE AND DIGITAL CIRCUITS

Objective: The objective of the course is to introduce a comprehensive treatment on the design and analysis of combinational and sequential circuits. The course trains the students to build any combinational circuit with logic gates and exclusively using universal gates. Under sequential circuits, emphasize is given to the variety of counter circuits both under synchronous and asynchronous cases. Also the course includes the discussions on the difficulties involved in the design of asynchronous sequential circuits. As far as analog circuits are concerned, fundamentals of pulse circuits will be discussed. Besides, the course introduces the operation of switching circuits with discrete components like BJT, FET, UJT versions. At the end of the course, the students will be able to model and design any type of digital circuits.

UNIT I: LINEAR WAVE SHAPINGCIRCUITS:

Linear wave shaping circuits: RC, RL and RLC circuits – Pulse transformer – Steady state switching characteristics of devices– Clipping and clamping circuits–Switching circuits.

UNIT II: MULTI-VIBRATORS AND TIME BASE CIRCUITS:

Bistable, monostable and astable multi-vibrators using BJT– Schmitt trigger circuit using BJT– Voltage and current sawtooth sweeps – Fixed amplitude sweep – Constant current sweep– UJT– Sawtooth Miller and bootstrap time base–Multivibrators using negative resistance devices (UJT and Tunnel diodes).

UNIT III: COMBINATIONAL CIRCUITS:

Binary arithmetic–BCD addition and subtraction–Code converters-Parity generator–Binary to BCD and BCD to binary conversions–Design of combination circuits using NAND and NOR gates–Design of encoders, decoders, multiplexers, de-multiplexer–Serial adders–Binary multiplier – Simplification of k-map, Flip-Flops : RS, D, JK and T types.

UNIT IV: SEQUENTIAL CIRCUITS:

Design of counters using Flip-flops– Synchronous, asynchronous, Up/Down counters, decade counter, ring counter, Johnson counter, BCD counter–Shift registers and bi-directional shift registers. Parallel/serial converters. Memory types and terminology – ROM – RAMs – Non-volatile RAMS – Sequential memories.

UNIT V: DESIGN OF SEQUENTIAL CIRCUITS:

Design of Synchronous sequential circuits: Model Selection – State transition diagram – state synthesis table – Design equations and circuit diagram– State reduction technique. Asynchronous sequential circuits – Analysis – Problems with asynchronous sequential circuits – Design of asynchronous sequential circuits State transition diagram, Primitive table, State reduction, state assignment and design equations.

Total : 45 hours

TEXT BOOKS

1. David A Bell, “Solid State Pulse Circuits”, 4th edition,PHI,2008.
2. A.P. Malvino and D.P. Leach, “Digital Principles and Applications”, TMH, 2006.

REFERENCE BOOKS

1. Floyd & Jain, “Digital Fundamentals”, Pearson Education, 2007.
2. William Gothmann, “Digital Electronics,: An Introduction to Theory and Practice”,2nd edition, PHI - 2008.
3. M.Morris Mano,”Digital Logic and Computer Design”, PHI, 2007.
4. Millman & Taub, “Pulse, Digital and Switching Waveforms”, McGraw Hill Book Co., 2005.

EE T46 OBJECT ORIENTED PROGRAMMING

Objective: The objective of the course is to make the students to understand the power of object oriented programming over structured programming. The course introduces C++ concepts and its methodologies. It enables the students to develop C++ classes for simple applications targeted for electrical and electronics engineering. Besides, the course introduces the features of the platform independent object oriented programming language– Java and enables the students to develop threads and applet programs using Java.On successful completion of the course, the students will be able to prepare object-oriented design for small/medium scale problems, to write a computer program for specific problems and use the Java SDK environment to create, debug and run simple Java programs and develop GUI based programs using JDK environment.

UNIT I: INTRODUCTION OOPS

Limitations of structured programming- Object-oriented paradigm, elements of object oriented programming–Merits and demerits of methodology-Datatypes-loops-pointers–arrays–structures – functions–Classes – Objects-Constructor and destructor

UNIT II: OVERLOADING FUNCTIONS AND FILES

Operator overloading–function overloading-Inheritance–multiple–multilevel–hierarchical-Virtual base class-friend function-Polymorphism–this pointer-virtual functions-pure virtual function-Input /Output streams-Files streams—manipulators – Templates

UNIT III: INTRODUCTION OF JAVA

Introduction to Java–Javavs. C++-datatypes–operators–Decision making-branching-loops-classes – objects-arrays-strings-methods-string handling.

UNIT IV: PACKAGES AND EXCEPTION HANDLING

Inheritance-Packages–API packages– creating packages– adding class to package-interfaces– multiple inheritance –Exception handling-predefined and user defined.

UNIT V: THREADS AND APPLETS (QUALITATIVE ANALYSIS)

Multi threaded programming–creating threads-extending the thread class-life cycle of threads-Applet Programming–applet life cycle-creating executable applet– passing parameters to applets-Streams in Java.

Total : 45 hours

TEXTBOOKS

1. E. Balaguruswamy,"Object Oriented Programming with C++", (4th Edition), Tata McGraw Hill Publications Limited, 2008 (Unit I & II)
2. E.Balaguruswamy,"Programming with Java-A Primer"(3rd Edition), Tata McGraw Hill Publications Limited, 2007. (Unit III, IV, V)

3. Patrick naughton, “The Java Handbook “,Tata McGraw Hill Publications Limited, 2006. (Unit III, IV, V)

REFERENCE BOOKS

1. K.R.Venugopal, Rajkumar Buyya, T. Ravishankar, "Mastering C++", TMH, 2003
2. Robert Lafore–“OBJECT ORIENTED PROGRAMMING IN TurboC++”, Waite Group; 3rd edition (December 1998)
3. Bruce Eckel, “Thinking in Java”, (4th Edition) Prentice Hall PTR, 2006
4. Herbert Schildt, "the Java 2 : Complete Reference", Fourth edition, Tata McGraw Hill Publications Limited, 2002.

EE P41 ELECTRICAL MACHINES LAB – II

(Aminimum of twelve experiments to be conducted in the followingTopics)

Objective: The objective of the course is to enable the students to realize the performance of AC generators under no load and load conditions. The students get familiarize with the load performance of different types of induction motors and synchronous motors.The course enables the students to understand the predetermination methods for finding the losses and efficiencies of AC motors and generators.

List of Experiments

INDCUTION MACHINES

1. Load test on 3-phase squirrel cage Induction Motor
2. Load test on 3-phase slip ring Induction Motor
3. No load & Blocked rotor test on 3-phase squirrel cage Induction Motor (Performance determination using equivalent circuit and circle diagram)
4. Load test on 1 phase Induction Motor
5. Load test on 3 phase Induction Generator
6. Study of speed control of Induction Motor
7. Study of Starters in Induction Motor

SYNCHRONOUS MACHINES

8. Load test on 1-phase Alternator
9. Load test on 3-phase Alternator
10. Pre-determination of voltage regulation of 3-phase Alternator by EMF, MMF &Potier Triangle Method.
11. Synchronization of 3-phase Alternator with bus bars
12. V and inverted V curve of an auto synchronous motor
13. Determination direct axis reactance and quadrature axis reactance of a salient pole alternator by slip test.
14. Performance Characteristics of Universal Motor

EE P42 ELECTRONICS LAB – II

(A minimum of TEN experiments to be conducted in the following Topics)

Objective: This course is intended to enable the students to design and analyze the operation of some of the basic analog electronic circuits such as amplifiers, oscillators and multivibrators. The course introduces the basic logic gates and flip-flops which help them to build any digital electronic circuits. Further, the students are introduced with some of the digital circuit applications like arithmetic circuits, multiplexers, demultiplexers and counters developed using logic gates and flipflops. At the end of the course the students are able to build up any type analog or digital electronic circuits.

List of experiments

1. Frequency response characteristics of a single stage RC coupled transistor amplifier.
2. Design of transistor based RCphase-shift oscillator.
3. Design of UJT relaxation oscillator.
4. Design of transistor based astable and monostable multivibrator.
5. Design of transistor based Schmitttrigger.
6. Study of logic gates, verification of de"Morgan laws using logic gates, implementation of basic gates using universal gates.
7. Study and design of adders, subtractors and combination of all logic circuits using K-map simplification.
8. Design of multiplexors andde-multiplexors using logic gates.
9. Design and testing of SR, D, JK (Master-slave configuration) and T flip-flops using universal gates.
10. Design of code converters using logic gates.
11. Design of 4-bit Up/Down and Mod-10 counter using Master-slave flip-flop IC 7476.

EEP 43 OBJECT ORIENTED PROGRAMMING LAB

(A minimum of TEN experiments to be conducted in the following Topics)

Objective: The objective of the course is to give hands on training with the C++ and Java compilers to the student. The course enables the students to develop their own codes, develop skills in debugging, testing and finally validating the programs. At the end of the course, the students excel in writing object oriented programs using C++ and Java,build their own user defined packages and interface and develop single and multi-threaded applications.

List of experiments

PROGRAMS IN C++/ JAVA

1. Classes and objects, Constructor and Destructors.
2. Function Overloading.
3. Inheritance.
4. Operator overloading.
5. Friend function, Templates.
6. Simple Java applications-Handling Strings in java.
7. Simple Package creation-Developinguser defined packages in Java.
8. Interfaces in JAVA.
9. Threading and Multithreading (Simple Experiments).
10. Exception Handling Mechanism in Java-Handling pre-defined exceptions-Handling user-defined exceptions.
11. Applets creations.

SP P 44 PHYSICAL EDUCATION

Physical Education is compulsory for all the Undergraduate students and Pass in this course is mandatory for the award of degree. Physical Education activities will include games and sports/extension lectures. The student participation shall be for minimum period of 45 hours. Physical Education activities will be monitored by the Director of Physical Education. Pass/Fail will be determined on the basis of participation, attendance, performance and conduct. If a candidate fails, he/she has to repeat the course in the subsequent years.

EE T51 COMMUNICATION ENGINEERING

Objective: The objective of the course is to understand the concept of analog and digital modulation techniques and to study various analog modems.The course enables the students to understand the need for error control techniques and to study the different error control schemes. Besides,it deliberates, the use of powerlines for communication. The course explores the role of communication engineering in the realization of smart grids.

UNIT I: ANALOG MODULATION SYSTEMS

Time and frequency domain representation of signals - Amplitude modulation – Spectrum & Power relations, SSB, DSBSC and VSB modulations, AM Modulator and Demodulator circuits – Transistor AMDSBFC modulator, Envelope detector. Frequency modulation – Frequency spectrum & modulation index, NBFM & WBFM. FM Modulator and Demodulator circuits – Reactance modulators, Armstrong Method, Balanced slope detector & Foster Seeley discriminator. Pre-Emphasis & De-Emphasis – Superheterodyne receiver.

UNIT II: PULSE AND DIGITAL MODULATION SYSTEMS

PCM system, Delta Modulation-Generation and detection of ASK, FSK and PSK-Bit Error Rate calculation-BER performance comparison- Digital T – Carrier system.

UNIT III: COMMUNICATION TECHNOLOGY

SPREAD SPECTRUM – PN sequence, Frequency hopping-Direct sequence spread spectrum systems. FDMA, TDMA and CDMA systems. Error Detection,Error correction- Hamming code, Block code, ARQ Mechanisms.

UNIT IV: WIRELESS NETWORKS

NETWORK PROTOCOL: TCP/IP Architecture, OSI Architecture, IEEE 802 Architecture, 1G,2G,3G Cellular Wireless Networks. WLAN, Bluetooth, Wimax, LTE networks.

UNIT V: POWER LINE COMMUNICATION

Power supply networks, Narrowband & Broadband PLC, Structure of PLC access network, PLC network elements, Connection to core network, Structure of campus communication network and performance issues. Architecture of Smart grid technology.

Total : 45 hours

TEXT BOOKS

1. Wayne Tomasi, ‘Electronic Communication Systems’, Pearson Education, Third Edition, 2001.
2. Roy Blake, ‘Electronic Communication Systems’, Thomson Delmar, 2nd Edition, 2002.
3. William Stallings, ‘ Wireless Communication and Networks’ Pearson Education, 2003.
4. Halid Hrasnica, Abdelfatteh Haidine, Ralf Lehneri, “ Broad band Powerline Communications Design”, John Wiley & sons, Ltd.

REFERENCE BOOKS

1. William Schweber, 'Electronic Communication Systems', Prentice Hall of India, 2002.

2. G. Kennedy, 'Electronic Communication Systems', McGraw Hill, 4th edition, 2002.

3. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Nick enkins " SMART GRID Technology and applications" John Wiley & sons Ltd., 2012.

4. Miller, 'Modern Electronic Communication', Prentice Hall of India, 2003

EE T52 ANALOG AND DIGITAL INTEGRATED CIRCUITS

Objective: The objective of the course is to introduce basic fabrication method of integrated circuits, features of various digital IC families, the characteristics of op-amps and the method of analysis and design of various circuits using op-amps. The course also discusses the design electronic circuits using PLL and timers. At the end of the course, the students will be capable to design and develop circuits using op-amps, timers and PLL.

UNIT I: IC FABRICATION AND LOGICFAMILIES:

Monolithic IC technology–planar process–Bipolar junction transistor–FET fabrication–
CMOS technology. DIGITAL IC's. Logic families; DTL, HTL, RTL, TTL, ECL, PMOS, CMOS, I^2L performance criteria -Comparison, applications, advantages.

UNIT II: OPERATIONAL AMPLIFIERS:

Introduction to Linear ICs– BJT differential amplifier-Operational amplifier IC 741–Block diagram and Characteristics - Inverting, non inverting and difference amplifier – Adder, Subtractor, Integrator, Differentiator-Comparator- Window detector- Regenerative comparator (Schmitttrigger) - Precision rectifier- Current to voltage converter – Voltage to current converter -Log and antilog amplifiers- Instrumentation amplifiers.

UNIT III: ANALOG IC APPLICATIONS

Series op-amp regulator – IC voltage regulator – Switching regulator – Digital to analog converters–specifications–weighted resistor type– R-2R ladder type-Analog to digital converter – specifications–counter ramp, flash, successive approximation, dual slope types-Voltage to frequency converter–Frequency to voltage converter– Analog multiplier.

UNIT IV: ACTIVEFILTERS AND WAVEFORM GENERATOR

First and second order Active filters-Low pass, highpass, bandpass and band reject filters-State variable filter-Switched capacitor filter–Waveform generator-RC Phaseshiftand Wien-bridge oscillators – Multivibrators– triangular and sawtooth wave generator.

UNIT V:PHASE LOCKED LOOP AND TIMER

PLL–principle-block diagram-phase comparator-VCO-lock-in range and capture range- PLL applications. IC555 timer-functional diagram-Astable and Monostable Multivibrators-Schmitttrigger-Missing pulse detector-dual timer -Applications.

Total : 45 hours

TEXT BOOKS

1. Ramakant A. Gayakwad, “Op-Amps and Linear integrated circuits”, PHI, 2008.

2.D.Roy Choudhury, Shail B. Jain, “Linear Integrated Circuits”,New Age International (P) Ltd, 2010.

REFERENCE BOOKS

1. Herbert Taub and Donald Schilling, "Digital Integrated Electronics", Tata McGraw Hill Edition, 2008.

2.Robert.F. Coughlin and Frederick F.Driscoll, “Operational amplifiers and Linear Integrated Circuits”, PHI Learning Pvt.Ltd, 6th edition, 2008.

EE T53 TRANSMISSION AND DISTRIBUTION

Objective: The objective of the course is to make the students to understand the structure of electric supply system and different types of distribution systems, to gain the knowledge ofline parameters, skin effect, proximity effect and corona in transmission lines. The course enables the students to learn the performance evaluation of different types of transmission lines by calculating transmission efficiency and voltage regulation. The course introduces the study on the selection of cables and insulators for specific applications and the design aspects of rural and town electrification schemes, HVDC and FACTS technology. At the end of the course, students will able to gain a thorough knowledge of transmission and distribution systems.

UNIT I: DISTRIBUTION SYSTEMS

Structure of electric power systems-one Line Diagram-generation, transmission and distribution Systems-comparison of distribution systems–radial and ring –two wire dc, ac single phase and three phase systems–current and voltage calculations in distributors with concentrated and Distributed loads – Kelvin'slaw for the design of feeders and its limitations.

UNIT II: TRANSMISSION LINE PARAMETERS

Resistance, inductance and capacitance of single and three phase transmission lines-symmetrical and unsymmetrical spacing–transposition-single and double circuits-stranded and bundled conductors-application of self and mutual GMD–Skin and Proximity effect-inductive interference-Corona-characteristics.

UNIT III: PERFORMANCE OF TRANSMISSION LINES

Development of equivalent circuits for short, medium and long lines–efficiency and regulation-Attenuation constant and phase constant- surge impedance loading –power circle diagrams for sending and receiving ends-transmission capacity, steady state stability limit–voltage control of lines -shunt and series compensation.

UNIT IV: INSULATORS AND CABLES

Insulators–types and comparison–voltage distribution in string insulator–string efficiency–Methods of improving string efficiency–Stress and sag calculations–effect of wind and ice–supports at different levels–stinging chart-cables– types–capacitance of cables–insulation resistance - dielectric stress and grading- dielectric loss- thermal characteristics- capacitance of three corecables.

UNIT V: RECENT TRENDS IN TRANSMISSION

Design of rural distribution, planning and design of town electrification schemes–comparison of EHVAC & HVDC system–economic distance for HVDC–terminal equipment for HVDC systems–description of DC transmission system–planning-advantages-interconnection of HVDC

& AC systems–Introduction to FACTS technology.

Total : 45 hours

TEXTBOOKS

1. C.L.Wadhwa, Electrical Power Sytems, 5th edition, New Age International (P) Limited, New Delhi, 2006.
2. V.K.Metha & Rohit Metha,"Principles of PowerSystem", S.Chand,2005.

REFERENCEBOOKS

1. S.L.Uppal, Electrical Power, Khanna Publishers,New Delhi, 2002.
2. Chakrabarti.A,Soni MI, Gupta PV,"Text book on power system engineering", Dhanpat Rai & Co,2008.
3. S.N. Singh, Electric Power Generation,Transmission & Distribution, Prentice Hall of India, New Edition, New Delhi, 2008.
4. Soni, Bhatnagarand Gupta, Electrical Power, Dhanpat Rai & Sons, New Delhi,2006.

EE T54 POWER ELECTRONICS

Objective: The objective of the course is to introduce the different power electronics circuits, like AC/DC, DC/DC and DC/AC converters, in power processing applications. The major power switching devices used in power electronics applications will be the preliminary objective. The operation, switching characteristics, triggering methods and protection of these devices will be handled in depth. Using these power switches, the construction and operation of various power electronic circuits like controlled rectifiers, choppers, inverters and cyclo converters will be discussed. Operation and performance evaluation of AC/DC power conversion circuit using controlled rectifiers will be discussed for different types of loads. Different types of inverters and various control strategies will be introduced for the same. Finally the use of these circuits in various applications will be discussed. At the end of the course, the students will be familiar with different power devices, various power converter circuits, their control strategies and applications.

UNIT I: POWER SEMI CONDUCTOR DEVICES

Power switching devices overview: ideal & real switching characteristics -power diode, BJT, SCR, TRIAC, MOSFET, GTO, IGBT- V-I characteristics, turn-on, turn-off methods; protection-di/dt,dv/dt,overcurrent, overvoltage; specifications, losses, thermal characteristics, series and parallel operation, triggering circuits.

UNIT II: CONTROLLED RECTIFIERS

Operation and analysis of single and three phase rectifiers – half and fully controlled Converters with R, RL and RLE loads with and without free wheeling diodes; converter and inverter operation – waveforms, gate time control, output voltage, input current, power factor, effect of load and source inductances. Power factor and harmonic improvement methods inconverters. Series converter, twelve pulse converters, dual converter – four-quadrant operation with and without circulating current.

UNIT III: CHOPPERS

Principles of high power chopper circuits –class A, B, C, D and E chopper, voltage commutated, current commutated chopper, multi-phase chopper-multi-quadrant operation, principle of operation of buck, boost and buck boost regulators; time ratio control, variable frequency control, duty cycle.

UNIT IV: INVERTERS

Principles of high power VSI and CSI inverters, Modified McMurray, auto sequential inverter–

waveforms at load and commutating elements; inverters: analysis of three phase inverter circuits with star and delta loads; control and modulation techniques: unipolar, bipolar schemes– voltage and frequency control; harmonics study.

UNITV : AC CHOPPER AND CYCLO CONVERETERS

AC voltage controller - Principle of single phase and three-phase AC voltage controller –ON/OFF and phase angle control Cyclo converters- Principle of single phase and three phase cyclo converters circuits, input and output performances-different control techniques and firing pulse generation. Applications – regulated power supply, UPS, solid-state motor starters, HVDC systems, reactive power compensation.

Total : 45hours

TEXT BOOKS

1. M.H.Rashid, "Power Electronics", PHI, New Delhi, 2007.
2. P.S. Bimbhra, "Power Electronics", Khanna Publishers, NewDelhi, 2008.

REFERENCE BOOKS

1. Ned Mohan, M.Underland, William P.Robbins, "Power Electronics Converters, applications and design",JohnWiley&sons, Singapore, 2001.
2. M.D.Singh, K.B.Khanchandani, "Power Electronics", Tata McGraw Hill, New Delhi, 2007.
3. Cyril W.Lander,"Power Electronics", McGraw Hill Book Company, Singapore(1993).
4. Williams B.W., "Power Electronics Devices, drivers, applications and passive components", McMillan Press Ltd., London, 1992.

EE T55 MEASUREMENTS AND INSTRUMENTATION

Objective: The objective of the course is to understand the basics of measurement and instrumentation and to acquire knowledge about calibration, and different types of electrical instruments. Also the course introduces the working principle of various bridges and magnetic measurements. The course facilitates the students to analyze the concepts of display devices and to be aware of transducers. At the end of the course, students will be familiar with a class of measuring instruments which will enable the students to identify and choose appropriate instruments for specific application.

UNIT I: INTRODUCTION TO MEASUREMENT

Elements of Generalized measurement system- Methods of measurement- Classification of instruments–Static & Dynamic characteristics of instruments-Mean, Standard deviation-Probability of errors-Types of error Accuracy, Precision, Sensitivity, Linearity, Resolution, Hysteresis, Threshold, Input impedance, loadingeffects.

UNIT II: ELECTRICAL MEASURING INSTRUMENT

Basic effects of electromechanical instruments–Ammeter and voltmeter–Moving coil–Moving Iron–Electrodynamo meter and induction type–Extension of range. Wattmeter–Dynamometer and induction type energy meter–induction type–Instrument transformers. Power factormeter–Synchroscope –Frequency meter-Digital voltmeter.

UNIT III: AC MEASUREMENT & MAGNETIC MEASUREMENTS

Measurement of resistance-Low Medium and High- AC bridges-Maxwell's, Hay's Anderson's for LDesauty'sbridge and Schering bridge for C and Wien'sbridge for measurement of frequency. B-H curve and hysteresis loop using ballistic galvanometer, and Loss measurement using wattmeter method.

UNIT IV: DISPLAY AND RECORDING DEVICES

LED & LCD Display Dot Matrix Display, 7 Segment Display Strip Chart Recorders Single point and multipoint Recorders–X-Y Recorders-MagneticTape Recorders-Data Loggers–Electromagnetic and Electrostatic interference.

UNIT V: TRANSDUCERS

Temperature transducers-RTD, thermistor, Thermocouple-Displacement transducer-Inductive, capacitive, LVDT, Pressure transducer–Bourdon tube, Bellows–Flow transducer– Electromagnetic flow meter – Strain gauges– Piezoelectric and Hall effect transducer.

Total : 45 hours

TEXT BOOKS

1. A.K. Sawhney,"A course of Electrical & Electronics measurements & instrumentation",

Dhanpat Rai & sons, 2007.

2. Kalsi H.S, ”Electronics Instrumentation, 2nd edition, TMH, 2004.

REFERENCE BOOKS

1. John P. Bentley, “Principles of measurement system”, Addison Wesley Longman (pvt.) Ltd., 2000.
2. G.S.Rangan, G.R.Sharmaand V.S.V.Mani,“Instrumentation devices and systems”,Tata McGraw Hill, 2000.
3. James W. Dally, William F.Riley, Kennath G. McCornell, “Instrumentation for engg. Measurements”, John Wiely & Sons (p) Ltd., 2003.
4. D.V.S. Moorthy, “Transducers & Instrumentation”, Prentice Hall of India, 2008.

EE P51 ELECTRONICS LAB – III

(A minimum of TEN experiments to be conducted in the following Topics)

Objective: The objective of the course is to introduce the students with various analog and digital integrated circuits and their applications. The students acquireknowledge about the design and development of analog electronic circuits like voltage regulators, amplifiers, oscillators, filters and multivibrators using appropriate analog ICs. Besides, the course enables the students to realize the operation of digital circuits like counters, code converters, multiplexers, demultiplexers, encoders, decoders and digital to analog converters using suitable ICs. At the end of the course the students will have a strong knowledge in the design and realization of any type of analog/digital electronic circuits.

List of experiments

1. Design of low and high voltage regulators using IC 723.
2. Design of inverting, non-inverting amplifiers and voltage follower circuit using OPAMP 741.
3. Design of analogue adder and subtractor using OPAMP741.
4. Design of analogue integrator and differentiator circuit using OPAMP741.
5. Design of log and antilog amplifier using OPAMP741.
6. Design of Wein-bridge oscillator using OPAMP741.
7. Design of RC phase shift oscillator using OPAMP741.
8. Design of filter circuits (Ist order and IInd order) using OPAMP741.
9. Design of comparator circuits (PWM and SPWM) and Schmitt trigger circuit using OPAMP741.
10. Digital to analogue converters using OPAMP741.
11. Design of Monostable and Astable multivibrator using IC555.
12. Design of ringcounter and Johnson counters.
13. Design of shift registers.
14. Study of Encoders and decoders.

EE P52 MEASUREMENT AND CONTROL LAB

Objective: The objective of the course is to enable the students to understand the basics of calibration and extension of range of different meters. Students acquire knowledge about the various circuit theorems using PSPICE simulation and control system oriented MATLAB experiments. The course enables the students to know the working principle of various bridges, magnetic and frequency measurements and analyze the concepts of signal converters, instrumentation amplifier and transducers.

List of experiments

1. Measurement of electrical parameters using bridges (resistance, inductance and capacitance).
2. Verification of network theorems (PSPICE Simulation and Practical method).
3. Extension of range and meters (voltmeter and ammeter).
4. Calibration of energy meters (single phase and three phase)
5. Measurementson supply systems (frequency, phase and phasesequence).
6. Measurements on Magnetic system (B-H loop and Magnetic Losses).
7. Operation amplifier application (Instrumentation amplifier, Signal converter with grounded and floating loads).
8. Transducer based experiments (Temperature and displacement and LDR).
9. Determination of transfer-function of DC Machine.
10. Verification of various exercises and plots in control system in MATLAB simulation.

HSP53 GENERAL PROFICIENCY-I

Objective: The need to make young graduates"employable"has become all the more important especially in the wake of looming manpower crisis that is of ten highlighted by media reports,and dismal employment ratio. Taking into consideration the"employability"factor this course has be endesigned to make the students linguistically proficient by honing their language skills. The course focuses on importance of communication, softskills, importance of speaking,etiquette, and verbal and numerical aptitude.

UNIT I: ARTOFCOMMUNICATION

Verbal and Non-verbal Communication–Barriers to Communication–Importance of BodyLanguage – Effective Listening–Feedback

UNIT II:INTRODUCATIONTOSOFTSKILLS

Attitude – Self-Confidence – Leadership Qualities – Emotional Quotient – Effective TimeManagement Skills– SurvivingStress– Overcoming Failure– Professional Ethics– InterpersonalSkills

UNIT III:WRITING

Importance of Writing–Written Vs SpokenLanguage–Formal andI nformal Styles of writing– Resources for improving writing– Grammar andUsage – Vocabulary Building – SWOT analysis

UNIT IV:SPEAKINGPRACTICE

Dialogue – Telephone Etiquette – Public Speaking – Debate – Informal Discussions – Presentations

UNIT V: APTITUDE

Verbal -non verbal-Numerical aptitude

Total : 45 hours

REFERENCES

1. Nicholls, Anne. MasteringPublicSpeaking. JaicoPublishingHouse,2003.
2. Aggarwal, R.S. Quantitative Aptitude.S.Chand&Co.,2004.
3. Leigh, Andrewand Michael Maynard. The PerfectLeader. Random HouseBusiness Books,1999.
4. Whetton.A.DavidandKimS.Cameron.DevelopingManagementSkills.PearsonEducation, 2007.

5. Sherfield M Robert. DevelopingSoft Skills Pearson Education, 2005.
6. Hair O‟ Dan, Friedrich W. Gustav andLynda Dee Dixon. Strategic Communication in Business and the Professions. Pearson Education,2008.

EE T61 POWER SYSTEM ANALYSIS

Objective: The objective of the course is to provide students a major design experience in Power system that prepares them for engineering practice. By the end of the course students will be able to model the Power System components including generator, line/cable, transformer, shunt element, and load. Formulate the network matrices for the Power Systems, formulate power flow problems and develop solution using Gauss, Gauss-Seidal, Newton-Raphson and Fast decoupled methods. Develop and solve the positive, negative, and zero sequence networks for systems consisting of machines, transmission lines and transformers. Analyse symmetrical and unsymmetrical faults and solve for the fault voltages and currents for single line to ground faults, line to line faults, and doubleline to ground faults and to do thes stability analysis by learning the concepts of Swing equation, Equal Area Criterion and transient Voltage Dip/Sagcriteria.

UNIT I: POWER SYSTEM COMPONENT MODELING

Representation of Power system components like synchronous machines, induction machines, transformers, transmission lines, loads etc,for steady state analysis-Perunit Quantities, Impedance and reactance diagram-Formulation of network matrices for the power systems-Bus impedance and bus admittance matrices, reduction techniques on network matrices for network changes.

UNIT II: LOAD FLOW ANALYSIS

Formulation of load flow equations-Solution of simple problems by considering voltage controlled buses, tap changing transformers, phase shift control, lineflow calculations-Effect due to new lines,loads and voltages- Gauss, Gauss-Seidel method, Newton-Raphson- Jacobian and Fast Decoupled method for calculating line voltages and real and reactive powers.

UNIT III: SYMMETRICAL COMPONENTS

Definition-Introduction-Review of symmetrical components-Transformation matrices used in resolution of unbalanced voltages and currents-Positive, Negative and Zerosequenc enetworks of power system components-Sequence networks of impedanceloads,Series impedance and Rotating machines-Representation of various types of faults in sequence networks.

UNIT IV: SHORT CIRCUIT ANALYSIS

Symmetrical Faults: Thevenin’s theorem and applications,short circuit analysis – Short circuit capacity –circuit breaker selection. Un symmetricalFaults: Derivation of fault current for LG, LL, LLG short circuits and development of interconnection of sequence networks.

UNIT V: STABILITY ANALYSIS

Definition and Classification of Power System Stability Model and System Equivalents problems -Swing equation–Equal Area Criterion – Critical Clearing Angle–Numerical Integration of the

Swing Equation–Transient VoltageDip/SagCriteria–Current Practices–Voltage Stability Margin–Stability based Power system blackout case studies.

Total : 45 hours

TEXT BOOKS

1. D. P. Kothari andI. J. Nagrath, "Modern Power System Analysis", Tata McGraw Hill PublishingCompany, New Delhi, 2006.

2.T.K.NagsarkarandM.S.Sukhija,"PowerSystemAnalysis"OxfordUniversityPress,New Delhi, 2007.

3. HadiSaadat, "Power System Analysis", Second Edition, McGraw Hill Publishers, 2002.

4.J.D.Glover,M.Sarmaand T.Overbye,"Power System Analysis and Design",Fourth Edition, CENGAGE – Engineering, 2007.

REFERENCE BOOKS

1.Arthur R.Bergen and VijayVittal,"Power System Analysis",Third Edition, PrenticeHallof India PrivateLimited, New Delhi, 2001.

2. JohnJ. Graingerand Stevenson Jr W. D., "Power System Analysis", McGrawHill, 2003.

3.PrabhaKundur,"Power System Stability and Control",Second Reprint Edition,Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2006.

EE T62 UTILIZATION OFELECTRICAL ENERGY

Objective: The objective of the course is to provide students a basic understanding of illumination, type of lighting schemes and lamps. It enables the students to acquire knowledge about different types of heating and welding and to understand the working principle of various electrical drives and their control. The course teaches the conceptof traction and enables the students to analyse the electrolytic process.At the end of the course, the students will be able to know about the proper utilization of electrical energy.

UNIT I: ILLUMINATION

Productionoflight–Determination of MHCP and MSCP – Polarcurves of different types of sources–Rousseau's construction–Lighting schemesand calculations–Factory lighting–Flood lighting– Electric lamps– Gaseous discharge – High pressure and low pressure.

UNITII:ELECTRIC HEATING AND WELDING

Resistance, Inductance and Arcfurnaces–Construction and fields of application–Losses in oven and efficiency-Highfrequency-Dielectric heating–Characteristics of carbon and metallic arc welding– buttwelding–spot welding.

UNIT III: ELECTRIC DRIVES AND CONTROL

Group drive–Individual drive–selection of motors–starting and running characteristics–Running characteristics-Mechanical features of electricmotors–Drives for different industrial applications-Choice of drives– power requirement calculation– power factor improvement.

UNIT IV:ELECTRIC TRACTION

Traction system–Speed timecharacteristics–Series and parallel control of D.Cmotors-Open circuited, shunt and bridge transitions–Tractive effort calculation–Electric braking–Tramways and trolleybus–A.C traction and recent trend in Metro rails .

UNIT V:ELECTROLYTIC PROCESSES

Electrolysis – polarization factor – preparation work for Electro plating – Tanks and other equipments–Calculation of energy requirements–Methodsofchargingandmaintenance–Ni- iron and Ni-cadmium batteries-Components and materials–Capacity ratingofbatteries.Energy Auditing–Energy Conservation techniquesf or domestic and industrial applications.

Total : 45 hours

TEXTBOOKS

1. UppalS.L,"Electric Power", KhannaPublishers,2002.
2. Chakrabarti.A,SoniMI,GuptaPV,“Textbookonpowersystemengineering”,DhanpatRai &Co, 2008.

REFERENCEBOOKS

1. N.V.Suryanarayanan, “Utilization of Electric Power”, WielyEasternLtd.,2001.
2. G.C.Garg, “Utilization ofElectric Powerand Electric Traction”, KhannaPublishers, 2006.

EE T63 MICROPROCESSORS AND MICROCONTROLLERS

Objective: The course objectives are to introduce the generalized concepts of functional blocks namely registers, ALU, timing and control, interfacing of the microprocessorunit (Intel8085). The course introduces the concept of interfacing memory and I/Odevices and data transfer techniques. Itenables the students to understand the functions of various peripherals namely programmable I/O ports, timers, interruptcontroller, keyboard/displayinterface, serial communication interface etc whichsupport efficient operation of the microprocessor. At the end of the course the students will able to know about the functions and operations of the microprocessors and microcontrollers and develop assembly code using different addressing modes for various applications.

UNIT I: MICROPROCESSOR ARCHITECUTRE:

8085 Microprocessor architecture–Registers,Arithmetic and logicsection,Timing and Control section and Interface section-Machinecycles and bustimings– Wait states–Introduction to architecture of Z80 and MC6800 microprocessors.

UNIT II: 8085 PROGRAMMING

Addressing modes-Conditionflags-Instructionset–Programming techniques–Arithmetic and logic operations on 8/16bitbinary/BCDnumbers,Counter and timedelay programs–Stack and subroutines -Code conversion. Software development systems and assemblers.

UNIT III: MEMORY I/O INTERFACINGAND INTERRUPTS

MemoryInterfacing-Compatibility between memory and microprocessorunit–Addressspace–Partitioning of addressspace–Interfacing inputdevices.Types of datatransfer–8085Interrupt structure-vectored interrupts –Interfacingdata converters.

UNIT IV: PROGRAMMABLE DEVICES AND MICROPROCESSOR APPLICATIONS

Study of Architecture and programming of ICs:Programmable Peripheral device(8255), Timer/ Counter (8253), Programmable keyboard displayinterfaces (8279) - Programmable interrupt controller (8259) - USART (8259). Microprocessor Applications-stepper motor control - temperature control-trafficlight control.

UNITV:8051 MICROCONTROLLER

Introduction to Microcontrollers– 8051– Architecture –programming -hardware -Input/Output portsand circuits-Memory -Counter andTimers- SerialdataInput/Output-Interrupts-interfacing-keyboard, LCD, ADCand DAC.

Total : 45 hours

TEXT BOOKS:

1. Ramesh Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, Fifth Edition, PenramInternational Publishing(India) Pvt.Ltd., 2011.

2. Kenneth J. Ayala„The8051 Micro controller Architecture, Programming and Applications,Penram Int.Pub, 1996.

3.M.Senthilkumar,M.Saravananand S.Jeevananthan,”Microprocessorsandmicrocontrollers”, Oxford university press, 2010.

REFERENCE BOOKS:

1.KennethL.Short,“MicroprocessorandProgrammingLogic”,SecondEdition,PrenticeHall, 1997.

2.DouglasV.Hall,“Microprocessorsandinterfacing:ProgrammingandHardware”,Second Edition, McGrawHillInc, 2006.

EE T64 ELECTRICAL MACHINE DESIGN

Objective: The objective of the course is to understand the design considerations of static and rotating electrical machines.The course refreshes the construction details of transformers DC and AC machines.Therefrom ,discusses the various design aspects of both DC and AC rotating electricalmachines.At the end of the course,the student will be able to design thevarious elements of DC machines, transformers, induction motors and alternators.

UNIT I: Fundamentals of Design

Rating and dimensions – Temperature rise – heating and cooling curves – rating of electricmachines - insulation requirements – insulation materials -MMF for air-gap - Net iron length – MMF for Iron - MMF for teeth – Real and Apparent flux densities - Leakage flux

UNIT II: Design of DC Machines

Magnetic circuit calculations-Output equation-Main Dimensions-Choice of specific electric and magnetic loadings-Selectionof Number of Poles- Armature design–Design of shuntfield coil– Design of commutator and brushes.

UNIT III: DesignofTransformers

OutputEquations of Single phase and three phase transformer–Main Dimensions- KVA output for single and three phase transformers–Window space factor–Overalldimensions– Determination of number of turns and length of mean turns of windings-Resistance of windings- No load current calculation.

UNIT IV: Design of ThreePhase Induction motor

Outputequation of Induction motor–Main dimensions–Length of air gap- Design of squirrel cage rotor-Rules for selecting rotor slots of squirrel cage machines–Design of rotorbars & slots– Design of end rings–Design of wound rotor

UNIT V: Design of Synchronous machines and Computer Aided Design

Outputequations–choice of loadings– Design of salient pole machines–Design of stator– Design of rotor–Design of damper winding–Design of turbo alternators–Introduction to CAD- Benefits-Flowchart methods.

Total : 45 hours

TEXT BOOKS

1. A.K.Sawhney,A.Chakrabarti,"ACourseinElectricalMachineDesign",DhanpatRai &Company, sixth edition 2006.
2. V.N.MittleandA.Mittle,„DesignofElectricalMachines‟,StandardPublicationsand

Distributors, Delhi, 2002.

3. Sen,S.K,"PrinciplesofElectricMachineDesignwithComputerProgrammes", Oxford &IBH PublishingCo. Pvt.Ltd., 2001, Reprint2004.

REFERENCE BOOKS

1. K.G. Upadhyay, „Designof Electrical Machines‟,New Age International Publishers, 2008.
2. R.K. Agarwal,"PrinciplesofElectrical MachineDesign", S.K.KatariaandSons,Delhi.
3. Shanmugasundaram, A., Gangadharan G. and Palani R., "Electrical Machine Design Data Book",NewAge international publishers (P)ltd., First edition 1979, Reprint2005.
4. H .M.Rai, "Principles of Electrical Machine Design", Sathyaprakashan, Delhi., 1988
5. P.P. Silvesterand Ferrari, "Finite Element for Electrical Engineers", Cambridge University Press, 1984.
6. A.E.Clayton, "Performance and design of Direct Current Machines", The English Language Book Society and Sir IsacPitman and Sons Ltd., London, 1962.

EE T65 DIGITAL SIGNAL PROCESSING

Objective: The objective of the course is to provide basic introduction to the theory of signal processing.The course discusses in detail about the study of DFT and Z transform techniques and its properties.The course enables the students to study the design and implementation of digital filters and the finite word length effects in signal processing.

UNIT I: DISCRETE TIME SIGNALS AND SYSTEMS

Basic elements ofs ignal processing-Sampling of analog signals–aliasing–standard discrete time signals-classification of discrete time signals-manipulations on discrete time signals-representation of discrete timesignals.Discrete time systems-properties-LinearTimeInvariant systems-convolution sum-properties of LTIsystems-difference equation representation.

UNIT II : DISCRETE TIME SYSTEM ANALYSIS

Z-transform–properties-inverse z-transform-difference equation–solution by z-transform-application to discrete systems-stability analysis-frequency response– convolution – Discrete Time Fourier Series-Discrete Time Fourier Transform.

UNIT III: DFT AND FFT

Discrete Fourier Transform-properties - relationship between z- transform, DTFT and DFT-Frequency analysis of signal using DFT. FFT algorithms-advantages over discrete computation of DFT –radix2 algorithms-Decimation In Time-Decimation InFrequency-Computation of IDFT using FFT.

UNIT IV:DESIGN OF DIGITAL FILTERS

FIR filter design-linear phase FIRfilters-Fourierseries method-windowing techniques–frequency Sampling techniques. IIR filter design-analog filter design-ButterworthandChebyshev approximations-digitalfilter design using impulse invariant technique and bilineartransformation method -warping, prewarping-Frequency transformation.

UNIT V: FILTER IMPLEMENTATION AND FINITE WORD LENGTH EFFECTS

Structures for FIR systems-directform,cascade and linear phase structures-structures for IIR systems-direct form, parallel, cascade and ladder structures- Representation of numbers-errors resulting in rounding and truncation-quantization of filtercoefficients-round off effects in digital filter–product quantization error, overflow limit cycle oscillations.

Total : 45 hours

TEXTBOOKS

1. John G. ProakisandDimitrisG. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”,PHIlearning, NewDelhi, Fourth Edition2008.
2. AlanV.OppenheimandW.schafer,”DiscreteTimeSignalProcessing”,PrenticeHallofIndia Pvt.Ltd., 2001.
3. Salivahanan.SandGnanapriyaC, “DigitalSignalProcessing”,TataMcGrawHill,New Delhi,2010.

REFERENCEBOOKS

1. RabinerandGold,“TheoryandApplicationsofDigitalSignalProcessing”,PrenticeHallof India Pvt.Ltd., 2001.
2. Mcclellan, Schaferand Yoder, “Signal processing first”, Pearson Education, 2003.
3. SanjitK.Mitra,“DigitalSignalProcessing:AComputerBasedApproach,TataMcGraw–Hill, Third Edition, 2005.
4. EmmanuelC.IfeachorandBarrieW.Jervis“DigitalsignalProcessing”,PearsonEducation, Second Edition, 2002
5. P.RameshBabu, “DigitalSignal processing”, ScitechPublications, FourthEdition, 2007.
6. A.Antoniou,”Digital filters: Analysisand design”,Tata McGrawHill.1990.

EE P61 POWER ELECTRONICS LABORATORY

(*A minimum of TEN experiments to be conducted in the following Topics*)

Objective: This course is intended to enable the students to understand the basics of trigger circuits required for various powerconverters.Students acquire knowledge about the operation of various power converter circuits namely controlled rectifiers, choppers, AC voltage regulators and inverters. The course enables the students to do simulation of these circuits using MATLAB/Simulink and experimentally verify the simulation results in the hardware lab. Besides, the students are introduced with some of the application of these power converters.

List of experiments

POWER CONVERTERS

1. Switching characteristics of MOSFET and IGBT
2. SCR Triggering circuits (using RC, UJT and counters etc)
3. Single phaseSemi and Full converters
4. Three-phase converter circuits
5. Forced commutation circuits
6. DC-DC converters (class A – E)
7. AC Voltage controllers
8. Single-phase and 3- phase PWM inverter
9. Non-PWM Inverters (120 and 180 modes of VSI , series and parallel inverters)
10. Cycloconverters

APPLICATIONS

11. Study of ZVS and ZCS buck converter
12. Speed control of AC/DC motors
13. Switched mode power supplies

EE P62 MICROPROCESSOR AND MICROCONTROLLER LAB

(*A minimum of TEN experiments to be conducted in the following Topics*)

Objective: The course objective is to equip the students with a good knowledge on Microprocessor and microcontroller programming and their applications. Besides, the course introduces the concept of interfacing,auxiliaryunits to the microprocessor and microcontroller. By the end of the course, the students will be able to write the assembly language programs in 8085 microprocessor and 8051 microcontroller and execute them.The course enables thes tudents to incorporate these concepts into their electronic designs, where control can be achieved via a microprocessor or microcontroller implementation.

List of experiments

I: 8085 Microprocessor based experiments:

1.8/16 bitarithmetic operations (Binary and BCD)
2. Block operation using pointers with and without toverlap
3. Generation ofSeries
4. Message Display(Moving &Flashing).
5. Digital clock Simulation using counters/interrupts.

II. 8051 Microcontroller based experiments:

6. Arithmetic operations
7. Code conversions
8. Array operations (searching, sorting)

III: Interfacing experiments (8085/8051 based):

9. Trafficlight interface.
10. Key-board/ DisplayInterface.
11. ADC/DAC interface-generation of Triangularwave and stair casewave.
12. Stepper motor interface

HSP63 GENERALPROFICIENCY– II

Objective: The course focuses on group discussions, resumes, adapting to corporate setup and aptitude.With everchanging demands of the industry,it has become imperative to equip the students with requisite skillsets and make them industry-ready/fit. The course offers aforum for the students to develop their language prowess and become“employable”.This course helps the students to understand the needs of the industry and enhance their employability/career prospectus.The course also aims at grooming the students holistically and making their transition from college to corporate world a hassle-freeone.

UNIT I: COMPOSITIONANALYSIS

Technical and Non-TechnicalPassages(GREBased)–Differences in American and British English – AnalyzingContemporaryissues– ExpandingTerminology

UNITII:WRITING

Job Application Letter Writing – Resume Writing

UNITIII:ORALSKILLS

GroupDiscussion–Introduction and Practice–TeamWork–NegotiationSkills–Organizing and AttendingMeetings– FacingInterviews

UNITIV:ADAPTINGTOCORPORATELIFE

Corporate Etiquette – Groomingand Dressing

UNITV:APTITUDE

Verbal – non verbal-numerical aptitude.

Total:45hours

REFERENCEBOOKS

1. Pushplata and SanjayKumar.Communicate or Collapse,“AHandbookofEffectivePublic Speaking,Group Discussions and Interviews”. Prentice-Hall, Delhi,2007.
2. Thorpe,Edgar,“CourseinMentalAbilityandQuantitativeAptitude”,TataMcGraw-Hill, 2003.
3. Thorpe, Edgar, “Test of Reasoning”, Tata McGraw-Hill,2003.
4. Prasad,H.M,“How to prepare for GroupDiscussionand Interview”,TataMcGraw-Hill, 2001.
5. Career PressEditors, “101 Great Resumes”, Jaico PublishingHouse, 2003.
6. Aggarwal,R.S,“A Modern Approach toVerbal&Non-Verbal Reasoning”,S.Chand&Co., 2004.

EE T71 INDUSTRIAL MANAGEMENT

Objective: The course industrial management introduces the core concept of management principles in an industrial environment. The principles of management and types of management like, financial management, production management and materials management will be covered indetail. The key aspects of sales and marketing management like advertising, sales promotion and sales forecasting will be discussed. Introduction to industrial psychology and personal management will help students get to know about the causes and remedies for fatigue, accidents and also the aspects of manpower planning and job analysis.

UNIT I

Introduction to Economics- Flow in an Economy, Law of Demand and Supply, Concept of Engineering Economics–Engineering Efficiency, Economic Efficiency, Scope of Engineering Economics, Elements of Costs, Marginal Cost, Marginal Revenue, Sunk Cost ,Opportunity cost, Break-Even Analysis, P/V ratio, Elementary Economics Analysis–Structure of Market, Pricing and its related factors.

UNIT II

Make or Buy Decision, Value Engineering– Function, Aims, Value Engineering Procedure, Interest formulas and their applications– Time Value of Money, Single-Payment Compound Factor, Single Payment Present Worth factor, Equal Payment Series Compound Amount Factor, Equal Payment Series Sinking Fund Factor, Equal Payment Series Present Worth Factor, Equal Payment Series Capital Recovery Factor, Uniform Gradient Series Annual Equivalent Factor, Effective Interest Rate, Examples in all the methods.

UNIT III

Methods of Comparison of Alternatives–Present Worth Method of Comparison (Revenue Dominated Cash flow Diagram, Cost Dominated Cash Flow Diagram),Future Worth Method Comparison (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Annual Equivalent Method of Comparison (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Rate of Return Method, Examples in all the methods.

UNIT IV

Principles of management: Basic concepts of management–Scientific management–Henry Fayol's Principles of management– Types and functions of management. Types of Organisation –characteristics, merits and demerits. Types of industrial ownership– Characteristics, merits and demerits.

UNIT V

Financial management: Sources of finance (Internal and External)-Types of capital-Working capital-Types of investment- Preparation of Trading, Profit and Loss Account and Balance Sheet-Types of Accounting and significance of each types.

Total:45hours

TEXTBOOKS

1. Panner selvam.R., Engineering Economics, Prentice-Hall Of India Pvt. Ltd, New Delhi, Feb-2013.
2. IM Pandey., Financial Management, Prentice-Hall Of India Pvt.Ltd
3. Management–Oxford University Press

REFERENCEBOOKS

1. Degaramo E.P., Sullivan W.G and Canada J.R., Engineering Economy Macmillan, Newyork.
2. GrantE.L.,Ireson W.Gand Leaven worth R.S.,Principles of Engineering Economy, Ronald Press, Newyork
3. Smith G.W. Engineering Economics, Lowa State Press,Lowa.

EE T72 SOLID STATE DRIVES

Objective: This course will make an engineering student to understand the performance of electric drives controlled from power electronic converters. Under the course, the students will come across characteristics, modeling and selection of motor power rating. They will be able to understand the operation and performance of converter and chopper fed dc drives. The course teaches solid state control of induction motors both from stator side and rotor side and closed loop operation of electric drives and various control techniques.

UNIT I: DRIVE CHARACTERISTICS

Characteristics of mechanical system-requirement of drive characteristics-selecting the drive elements-modeling of dc motor- selection of motor rating-P, PI and PID controllers- constant HP and constant torque operations.

UNIT II: DC DRIVES

Single phase and three phase drives- half controlled and fully controlled- Chopper drives- class A, B, C, D and E chopper drives- braking of dc drives.

UNIT III: STATOR SIDE CONTROLLED INDUCTION MOTOR DRIVE

Stator voltage controlled induction motor drive - slip torque characteristics- different configuration of controller's input current-closed loop operation. Stator frequency controlled induction motor drive-Slip-torque characteristics; harmonic equivalent Circuit- Rotating magnetic fields-harmonic current-efficiency-torque; stability**.**

UNIT IV: ROTOR SIDE CONTROLLED INDUCTION MOTOR DRIVE

Rotor Resistance Control: slip-torque characteristics- equivalent chopper resistance- chopper circuit filter-constant current operation. Slip Power Recovery Scheme: Slip power recovery scheme-sub synchronous operation; performance prediction- input power factor.

UNIT V: SYNCHRONOUS MOTOR DRIVES

Open loop volts/hertz control and self-control of synchronous motor: Marginal angle control and power factor control. Introduction to vector control-Principles and types.

TEXT BOOKS

Total : 45 hours

1. G.K. Dubey," Fundamentals of Electric Drives" Alpha Science International Ltd. 2001.

2.R.Krishnan,"ElectricMotor&Drives:Modelling,AnalysisandControl",PrenticeHallof India, 2001.

REFERENCE BOOKS

1. BimalK. Bose,"Modern Powe rElectronics and AC Drives",Prentice-hall o fIndia Pvt Ltd, 2005.

2. M.H.Rashid, "Power Electronic Circuits, Devices and Applications", Prentice Hall International, 2007 Edition, Newness Publications, 2006.
3. S.S.Dewan,G.R. Sleman and A.Straughen" Power Semi conductor Drives",JohnWileysons, 2008.

EE T73 POWER SYSTEM OPERATION AND CONTROL

Objective: The objective of the course is to introduce these curity aspects of the power system, basic structure of power system operation and control, load forecasting and unit commitment, active power control, dispatch schedule, voltage control, generation and absorption of reactive power. This course will enable the students to solve the economic load dispatch problems, understand the fundamentals of excitation system, generation and absorption of reactive power and voltage control methods.

UNIT I: SECURITY CONCEPTS

Power system security- Factors affecting system security- Different operating states of power Systems-energy control centers and its functions- Necessity for regulation of system frequency and voltage- Power systems control problems; P-F and Q-V control structure-SCADA systems.

UNIT II: LOAD FORECAST AND UNITCOMMITMENT

Load and load duration curves; Load forecasting, components of system load, classification of Base load, forecasting of the base load by method of least square fit-Introduction to unit commitments constraints on unit commitment, unit commitment using priority ordering load dispatching and dynamic programming method.

UNIT III: ACTIVE POWER CONTROL

Power control mechanism of individual machine- mathematical model of speed governing Mechanism- speed load characteristics of governing mechanism-Regulation of two generator sin parallel- Division of power system into control areas-LFC control of a single area; static and dynamic analysis of uncontrolled system- proportional plus integral control of a single area- LFC control of two area system -uncontrolled case, static and dynamic response-Tie line with frequency bias control of two area.

UNIT IV: DISPATCH SCHEDULE

Incremental cost curve- co-ordination equations with losses neglected- solution by iteration- co-Ordination equations with loss included (No derivation of Bmn co-efficient) solution of co-ordination equations using Bmn co-efficient by iteration method, Base point and participation factors; Economic dispatch controller added to LFC.

UNITV: VOLTAGE CONTROL

Fundamental characteristics of excitation system; Block diagram model of exciter system-Generation and absorption of reactive power-methods of voltage control-static shunt

capacitor/inductor VAR compensator- tap changing transformer; comparisons of different types of compensating equipment for transmission systems.

Total : 45 hours

TEXTBOOKS

1. Olle I. Elgerad,“Electric Energy SystemTheory and Introduction”,Tata McGraw Hill Publishing company, New Delhi, 2nd edition, 2004.
2. Allen J.Wood,BruceF.Wollen barg,“Power Generation,operation and control”,2nd edition, John Wiley and sons, 2008.

REFERENCE BOOKS

1. D.P.Kothar and I.J.Nagrath, " Modern Power System Analysis” Tata Mc GrawHill Publishing company Ltd., 2003.
2. Prabha Kundur, "Power System Stability and Control" Tata McGrawHill publishing companyLtd., 2006.
3. A.K.Mahalanbias ,D.P.Kothari & S.I.Ahson,"Computer Aided Power System Analysis and Control"Tata McGrawHill publishing company,New Delhi, 1990.
4. P.S.R. Murty,"Operation and Control in Power Systems" BS Publications, 2005.

EE P71 POWER SYSTEM SIMULATION LAB

(A minimum of TEN experiments to be conducted in the following Topics)

Objective: This course is intended to enable the students to acquire knowledge on the programming and simulation of powersystems using computer package MATLAB. Itintroduces M-fileprogramming in MATLABfor array, matrixoperations and plotting of Graphs.By the end of the course, students will be able to develop MATLAB programs for computation of power system components in perunits,formulation of the busadmittance and impedance matrices,load dispatch, load flow, shortcircuit and transient stability studies.

List of experiments

1. Computation of Power System Components in Per Units.
2. Formulation of the bus admittancematrix by Direct inspection and Singulartransformation method.
3. Formation of bus impedancematrix by Building algorithm method
4. Load Flow study by Gauss– seidel method
5. Load Flow study by Newton– raphson method
6. Load Flow study by Fast decoupled method.
7. Symmetrical components for different case studies.
8. Short circuit studies fors ymmetrical and unsymmetrical (LL,LG,LLG) faultstudies.
9. Numerical Integrationof Swingequation.
10. The Equal-AreaCriterion.
11. Economic/OptimalLoad Dispatch.
12. Load FrequencyControl.

TEXT BOOKS

1. RudraPratap, "Getting started with Matlab"Oxford University Press ,3rd edition 2012.

2.DuaneHanselman and BruceLittlefield,"The student edition of Matlab",PrenticeHall,New Delhi, 4th edition 2010.

EE PW7 PROJECT WORKPHASE – I

The objective of the projects is to enable the students to work in convenient group of not more than four members in a group on a project involving analytical, experimental, design combination of these related to one or more areas of Electrical & Electronics Engineering. Each project shall have a guide who is member of faculty of Electrical &Electronics Engineering.

Six periods per week is allotted for the phase-I of the project work. Each group of students should complete the project literature survey, problem statement methodology with few results. The guide and departmental committee shall evaluate the student's work for 100 marks based on one project presentation and internal viva-voice.

EE P72 SEMINAR

The objective of seminar is to enable the students to work in convenient groups (not more than four members in a group) and present a seminar on any chosen topic connected with Electrical & Electronics Engineering. The topics hall be chosen in consultation with a Faculty member. Each group is expected to make a critical review of literature and prepare are port on the topic. The students are expected to present as seminar. A departmental committee shall evaluate the performance of the students for100 marks.

EE P73 INDUSTRIAL VISITS/TRAINING REPORT

During the course of study from 3rd to 6th semester each student is expected to undertake a industrial visit and training. The minimum requirements shall be three units. A unit is defined as one industrial visitor one week industrial/ field training. The students are expected to submit a report, which shall be evaluated by a Departmental Committee at the end of seventh semester for 100 marks.

EE T81 PROTECTION AND SWITCHGEAR

Objective: The subject aims to introduce the power system protection and the working of relays. This subject will enable the students to understand the types of relays that are application specific, design of protection equipment for each power system component based on the performance metrics like generator capability curve and fault calculations, study the types of circuit breakers and fuses and their construction.

UNIT I: INTRODUCTION AND GENERAL PHILOSOPHIES

Basic objectives of System Protection–Essential Qualities and Operating Principles of the Relay –Classification and Performance of Relays–Torque Equation–RX Diagram– Phasors and Polarity– Relay Input Sources– Relay Margin–Blackout Case Study.

UNIT II: RELAY FUNDAMENTALS AND CHARACTERISTICS

Differential Principle- Over current– Back up Relay- Directional Scheme- Distance Relays– Impedance, Reactance and Mho-Under frequency and Negative sequence Relays- Microprocessor Applications and Substation Automation– Zones of Protection. Static relay circuits using analog and digital ICs for over current, differential, generator field loss, under frequency, distance, impedance and reverse power relays.

UNIT III: COMPONENTS PROTECTION

Generator Capability Curve– Short circuit Calculations– Ground fault and unbalanced current Protection–Over excitation and Abnormal Frequency Protection-Field winding Protection– Loss of Synchronism–Motor Protection; Transformer Protection–Differential ,Inrush and Over Current; Bus zone Protection; Protection of Transmission Lines; Relay coordination of a sample system – Concept of Wide Area Monitoring and Protection.

UNIT IV: DESIGN ASPECTS OF CIRCUIT BREAKERS

Basic considerations for the design-Arcing Phenomena and Arc Quenching; Properties of Arc and Interruption theories- Circuit Breaker Rating–RRRV-Current chopping and Capacitive current breaking–Duties of Switch Gear–Testing of Circuit Breakers- Recent Developments in Circuit Breaker Design and its Operation.

UNIT V: CIRCUIT BREAKERS

Construction and Operating Principles -Oil Circuit Breakers-Air Blast Circuit Breakers – Vacuum Circuit Breaker–SF_6 Circuit Breakers- DC Circuit Breakers–Fuse Characteristics– Operation of HRC and Photovoltaic fuses

Total : 45 hours

TEXT BOOKS

1. Blackburn J.Lewis, “Protective Relaying: Principles and Applications”,Third Edition,CRC Press, NewYork, 2006.

2. B.Ravindranath and N.Chander,"Power Systems Protection and Switchgear",JohnWiley & Sons (Asia)Pvt Ltd., New Edition, 1988.

REFERENCE BOOKS

1. Stanley H.Horowitz and Arun G.Phadke,“ Power System Relaying”,Second Edition, John Wiley& SonsInc. 1995.
2. Donald Reimert, “Protective Relaying for Power Generation Systems”, Taylor &Francis, New York, 2006.
3. Sunil S. Rao, "Switchgear Protection and Power Systems: Theory, Practice &Solved Problems”, Khanna Publishers, NewDelhi, 2007.
4. Y.G.Paithankar and S.R.Shide,“Fundamentals of Power System Protection”,PHILimited, 2004.Van C Warringlon,“Protective Relays–Their Theory and Practice”, vol. II ,Champ man& HallLtd.,London, 1969.
5. T.S.MadhavaRao,“PowerSystemProtection–StaticRelays”,TataMcGrawHill,NewDelhi, 1984.

EE PW8 PROJECT WORK PHASE – II

The objective of the projects is to enable the students to work in convenient group of not more than four members in a group on a project involving analytical, experimental, design combination of these related to one or more areas of Electrical& Electronics Engineering. Each project shall have a guide who is member of faculty of Electrical &Electronics Engineering.

Twelve periods per week is allotted for the phase-II of the project work. Each group of students should complete the project and prepare a report covering literature survey, problem statement methodology, results and conclusions. The guide and departmental committees hall evaluate the student's work for 50marks based on one seminar and one internal viva-voice. The student shall take up the viva-voce before a committee comprising of an external and an internal examiner, which evaluates the students work for100 marks.

EE P81 COMPREHENSIVE VIVAVOICE

A departmental committee for 100 marks for internal assessment evaluates the students on all areas of Electrical &Electronics Engineering. They also shall be examined by a panel of examiners (An internal examiner and an external) on all areas of Electrical& Electronics Engineering at the end of8thsemester.

EE P82 PROFESSIONAL ETHICAL PRACTICE

The course should covered the following topics by way of Seminars, Expert Lectures and

ASSIGNMENTS

Engineering Ethics– Moral issues, Ethical theories and their uses Engineering as Experimentation– Code of Ethics Engineer's responsibility for safety Responsibilities and rights Global issues of engineering ethics

REFERENCEBOOKS

1. MikeMartin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw-Hill, 2003

EE E01 NETWORK ANALYSIS AND SYNTHESIS

Objective: The objective of this course is to make the students capable of analyzing any given electrical network and to learn how to synthesize electrical network from a givenimpedance/admittance function. To implement the methods of active and/or non- bilateral, as well as passive bilateral network analysis and synthesis. Also this course aims at giving adequate exposure in the applications of Laplace transform, Fourier series and Fourier transform

UNIT I: TWO PORT NETWORK

Driving Point impedance and admittance of one port network – Open circuit impedance – Short circuit admittance of two port networks – Characterization of two port network in terms of Z , Y, H and T and ABCD parameters – interconnections of two port networks – T and π representation – Analysis of T, Ladder,Bridged – T and lattice networks.

UNITI: NETWORK FUNCTIONS

Concept of complex frequency, poles &zeros of network functions for one port & two port, Restrictions of poles & zero locations in the complex plane- Driving point & transfer functions of two port parameters, Time domain and frequency domain response from pole zero plots- Stability – Routh's –Hurwitz Criterion.

UNIT III: TRANSFORM ANALYSIS

Laplace transformation- Initial and Final Value therom – Application to linear network systems – Fourier series – Fourier transforms

UNIT IV: Network Synthesis

Positive real function – Properties - Brune's positive and real function (PRF), properties of PRF, testing of driving point functions, even and odd function, one terminal pair network driving point synthesis with LC elements, RC elements, Foster and Cauer form.

UNIT V: Filters

Low pass filters, high pass filters, band pass filters, band reject filters, Gain equalizer and delay equalizers, Butterworth filters, m-derived filters, constant k-filters, design of filters.

Total : 45 hours

Text Books

1. M.E. Van Valkenburg, Network Analysis, PHI.
2. F.F.Kuo, Network Analysis & Synthesis, John Wiley &Sons
3. C. L Wadhwa, Network Analysis & Synthesis, New Age International

Reference Books

1. M.E. Van Valkenburg, Introduction to Modern Network Synthesis, Wiley Eastern Ltd.
2. GobindDaryanani, Principles of Active Network Synthesis & Design, Wiley &
Sons.

EE E02 MODERN CONTROL SYSTEMS

Objective: The objective of the course is to introduce classical controller synthesis techniques like PI control ,lead-lag compensation and state space analysis of linear dynamic systems. Modelling and analysis of systems in state space domain will be dealt in detail. The students will be able to design controllers using state-feedback control approach. The optimal control using LQR technique will be taught. At the end of the course, the students will be able to analyse and synthesize controller for linear systems in state-space framework.

UNIT I: INTRODUCTION TO CLASSICAL DESIGN

Introduction to compensating networks – lead, lag, lead-lag compensation – feedback compensation – P, PI, PID controllers– design using Bode plot and root locus techniques.

UNIT II: STATE SPACE ANALYSIS

State space formulation–state variable–phase variables and canonical variables–state model From differential equation–state transition matrix–state space representation of discrete time systems

UNIT III: STATE SPACE DESIGN

Eigen values and Eigen vectors – Diagonalization– canonical forms - Controllability and observability –Controller design by state feedback–Necessary and sufficient condition for arbitrary poleplacement-stateregulatorproblem.ObserverDesign–Fullorder/reducedorder observer design

UNIT IV: STABILITY

Stabilityconcepts–BIBOAsymptoticstability-stabilitydefinitionsinstatespacedomain– Stability theorems on local and global stability–Lyapunov stability analysis- Krasovskii Method.

UNITV: OPTIMAL CONTROL

Linear quadratic optimal regulator (LQR) problem formulation–optimal regulator design by parameter adjustment (Lyapunov method) – optimal regulator design by Continuous - time Algebraic Riccatti Equation (CARE)– optimal controller design using LQG framework.

Total : 45 Hours

TEXTBOOKS

1. K.Ogata,'Moderncontrolengineering',3rd edition, Prentice Hall of India Pvt.Ltd.,New Delhi, 2000.
2. J.Nagrath and M.Gopal," Control systemsEngineering",4th edition, New Age International

Pvt Limited, New Delhi,2006.

REFERENCE BOOKS

1. Biswa NathDatta,"Numerical methods for linear control systems', Elsevier, 2005
2. M.Gopal," Digital Control and state variable methods", TataMc GrawHill,NewDelhi, 2003.

EE E03 FUZZY AND NEURAL SYSTEMS

Objective: Soft computing techniques have been successfully applied to numerous industrial applications. The course introduces the fundamental concepts of Neural and Fuzzy systems. It introduces concepts of Fuzzy set theory, Fuzzy inference mechanisms and defuzzification concepts. The student will be given a basic understanding of the fundamentals of an artificial Neural Network. The course introduces Neural learning types such as supervised learning and unsupervised learning. Finally, some design examples for fuzzy and neural based applications will be discussed.

UNIT I

Conventional sets verses fuzzy sets – Basic concepts and definitions. Operation in fuzzy sets– NOT, AND and OR operators. Convexity of fuzzy sets-lamda acts on fuzzy sets. Membership functions -type's choice and membership value assignment methods.

UNIT II

Fuzzy relations–equivalence and tolerance- Fuzzy if then rules– types. Rule based models– Mamdani and TSK models. Fuzzy to grisp conversions– defuzzification types.

UNIT III

Fuzzy control systems– Simple and general controllers– applications-Introduction to neural network– single and multi-input neurons. Transfer function-network architecture.

UNIT IV

Perception architecture-learning rule–limitations-linear seperability–multilayer perception- Back propagation algorithm– advantages, drawbacks and applications.

UNIT V

Brief theory of bidirectional associative memories and Adaptive resonance theory- Neuro-fuzzy systems– Application of neural and fuzzy system to electrical Engineering.

Total: 45 Hours

REFERENCES

1. Timothy. J. Rose, "Fuzzy logic with Engineering applications",McGraw Hill1999.
2. Hagen, Demuth and Beale, "Neural Network design", Thompson learning,2002.
3. John Yen, RezaLangani pearson, "Fuzzy logic",Education, 1999.

EE E04 ENERGY ENGINEERING

Objective: The objective of the course is to introduce various energy resources right from the conventional energy systems to upcoming renewable energy systems. The course offers details on hydro electric technology, wind, solar and biomass energy technologies. Besides, It enables the students to understand the necessity of energy conservation and management.

UNIT I : Energy Resources

Perspective of energy resources- Forms of Energy- World's energy status- Energy reserves of India- India's Power Scenario- Renewable Energy Sources- Energy parameters- Energy Intensity- Gross Domestic product.

UNIT II: Conventional Energy Sources

Coal fired steam thermal power plant– layout, working principle- Gas turbine power plant– various options, layout, working principle- Nuclear power plants: fuels, nuclear fuel cycle, reactors, nuclear power plant, and nuclear waste management.

UNIT III : Hydro and Ocean Energy Electric Technologies

Hydro Electric plants – Types, energy conversion schemes, power equation, environmental aspects– Hydro-Thermal co ordination-Ocean Energy Technology- Power plant-limitations.

UNIT IV: Wind, Solar Energy and DG Technologies

Wind turbine types and construction– wind energy conversion systems- grid connection- environmental aspects. Solar energy basics- Solar PV plant- Distributed Generation- Impacts- Benefits.

UNIT V: Energy Conservation and Management

Principle of energy conservation- waste heat recovery –Heat Exchanger– Economics of energy Conservation-co generation- Definition and Objectives of Energy Management, Energy Management System, Top management support, Energy policy purpose, Roles and responsibilities of energy manager**.**

Total : 45 hours

TEXT BOOKS

1. S.Raoand Dr.B.B.parulekar, "Energy Technology", Khanna pub.,Third edition, 1999.
2. Non-conventional energy resources by B.H.Khan,TMH, 2006.
3. Desai,AV,"EnergyDemand:Analysis,ManagementandConservation",Wiley Eastern Limited, 1990.
4. D.P.Kothari, K.C.Singal, RakeshRanjan."Renewable Energy Sources and Emerging Technologies", PHI, 2011.

REFERENCE BOOKS

1. G.D.Rai, “Non-conventional energy sources”, Khanna pub. Fourth Edition, 2002.
2. Pulfrey,D.L., Photo voltaic Power Generation, Van Nostr and Co., 1983.
3. Abbasik“Renewable Energy Sources and their Environment”, PHI, 2008.
4. B.Mohanty, R.S.Liu, U.V Krishna Mohan Rao, “Energy Audit Management for the Indian Industry”,Directorate the Institute of Charted Accountants of India,NewDelhi, 2001.
5. Encyclopedia of Energy– McGrawHill Publication.
6. Energy Management Handbook, JohnWiley&Sons, Wayne C.Turner.

EE E05 ELECTRICAL SAFETY AND QUALITY MANAGEMENT

Objective: The objective of the course is to introduce IE rules and its significance, electrical safety in residential, commercial and industrial installations. It also helps the students to know about the electrical safety in during installation, testing and commissioning, operation and maintenance. Besides, it enables the students to know more about the quality management.

UNIT I: REVIEW OF IE RULES AND ACTS AND THEIR SIGNIFICANCE

Objective and scope– ground clearances and section clearances– standards on electrical safety- safe limits of current, voltage–earthing of system neutral –Rules regarding first aid and fire fighting facility.

UNIT II: ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS

Wiring and fitting–Domestic appliances– water tap giving shock–shock from wet wall–fan Firing shock–multi-storied building–Temporary installations–Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT III: SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE

Preliminary preparations–safe sequence–risk of plant and equipment–safety documentation– field quality and safety - personal protective equipment – safety clearance notice – safety precautions – safe guards for operators– safety.

UNIT IV: ELECTRICAL SAFETY IN HAZARDOUS AREAS

Hazardous zones–class0,1 and 2– spark, flash overs and corona discharge and functional requirements– Specifications of electrical plants, equipments for hazardous locations– Classification of equipment enclosure for various hazardous gases and vapours– classification of equipment/enclosure for hazardous locations.

UNIT V: QUALITY MANAGEMENT

Total quality control and management–Importance of high load factor– Disadvantages of low power factor –Causes of low P.F.– power factor improvement– equipments– Importance of P.F. improvement.

Total: 45 Hours

REFERENCES

1. S. Rao, Prof. H.L. Saluja, "Electrical safety, fire safety Engg And safety management", Khanna Publishers, NewDelhi, 1988.

2. Pradeep Chaturvedi, “Energy management policy, planning and utilization”, Concept Publishing company,New Delhi, 1997.

3. Nagrath. I.J. and Kothari. D.P. “Power System Engineering”, Tata McGrawHill Publishing company Ltd. New Delhi, 1998.

EE E06 SPECIALELECTRICAL MACHINES

Objective: The objective of the course is to explore the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines. The main objective is to impart knowledge on constructions, working and performance of fractional hp machines, switched reluctance motor, PMSM and PMBL DC motors, construction, working and principle of operation, control and closed loop operation of stepper motors.

UNIT I: STEPPER MOTORS

Constructional features-principle of operation-Types of motors– Modes of operation–Drive system and circuit control of Stepper motor –Static and Dynamic Characteristics and Applications.

UNIT II: SWITCHED RELUCTANCE MOTORS

Constructional details-principles of operation- Static and dynamics Torque production–drive circuits–Current regulation–Torque speed characteristics– Speed and torque control– Static observers for rotor position sensing– volt- ampere requirements– Applications.

UNIT III: SYNCHRONOUS RELUCTANCE MOTORS

Constructional features – Types – Axial and radial air gap motors – Operating principle – Reluctance– Phasor diagram-Characteristics – Vernier motor.

UNIT IV: PERMANENT MAGNET BRUSH LESSDC MOTORS

Commutation in DC motors– Difference between mechanical and electronic commutators– Principle of operation- Construction and–drive circuits–Torque and emf equation– Torque and Speed characteristics– sensors and sensor less systems– controllers and applications.

UNIT V: PERMANENT MAGNET SYNCHRONOUS MOTORS

Principles of operation–Constructional features– Phasor diagram–torque speed characteristics –torque and emf equations–vector controllers- applications. Doubly Fed Induction Generator– Principle – construction, characteristics and applications.

Total : 45 hours

TEXT BOOKS

1. P.P.Acarnley," Stepping Motors, A Guide to Modern theory and practice", Peter Peregrines, London, 2002.

2. Venkataratnam K, “Special Electrical Machines”, Universities Press, Hyderabad,3ird Edition 2009.

REFERENCE BOOKS

1. A. Hughes,"Electric Motors and Drives", Affiliated East-West Press Pvt., Ltd., 2007

2.R.Krishnan,"Electric Motor Drives Modeling, Analysis, and Control" Prentice Hall of India PvtLtd, 2003.

3. R.K.Rajput, "Electrical Machines "Laxmi Publications, New Delhi, 2009

4.T.J.E.Miller, "Brushless Permanent Magnet and reluctance Motor Drives",Clarendon Press, Oxford, 1988

EE E07 BIOMEDICAL INSTRUMENTATION

Objective: This subject introduces the basics of electro physiology, transducers for bio-medical applications, biomedical measuring instruments, biotelemetry and pulmonary measurement. It helps the students to acquire knowledge about the recent trends in medical imaging systems such as CAT and CT scan and analyse the working of therapeutic units.

UNIT I: ELECTROPHYSIOLOGY

Review of Physiology and anatomy–sources of Bio electric Potentials– Resting and Action Potentials– Propagation of Action Potentials– Electrodes theory– Biopotential electrodes–Bio chemical transducers – Transducers for Bio Medical applications.

UNIT II: BIOMEDICAL MEASUREMENT AND RECORDERS

Physiology of cardiovascular and nervous system – ECE – EEE - EME – Foetal ECE- Phono cardiography–Vector Cardiography– Holtel monitoring–BP–Blood flow–cardiac output–ICCU – Bedside unit and central monitoring unit.

UNIT III: PULMONARY MEASUREMENT AND BIOTELEMETRY

Physiology of respiratory system – Respiratory rate measurement – wine and wireless Biotelemetry–Telemetering multiple information–implanted transmitters–sauces of electrical hazards and safety techniques.

UNIT IV: MEDICAL IMAGING SYSTEM

Ultrasound scanner–Echo cardiography–Coloar Doppler system–CAT and CT scan–MRI Imaging– Cineangio gram–LASER Imaging– Endoscope.

UNIT V: THERAPEUTICUNITS

Physiotheraphy and Electro theraphy- Shortware, Microwave diathermy–Defibrillators–Cardio vector – Hearing aid– dialysis machine.

Total : 45 hours

TEXTBOOKS

1. Leshie Cromwell,Fred .J. Weibell and Erich.A.Pfeiffer,“Biomedical Instrumentation and Measurements”, 2nd Edition, PHI, 2003.
2. R.Anandanatarajan,“Biomedical Instrumentation and Measurement”, I Edition, PHI

Learning Pvt.Limited, NewDelhi, 2011.

REFERENCEBOOKS

1. R.S.Khandpar,“Hand Book of Biomedical Instrumentation and measurement”, McGrawHill Publishing Co., 1990.
2. Aston, “Principles of Biomedical Instrumentation and measurements”, McGraw Hill Publishing Co., 1990.

EE E08 FACTS CONTROLLERS

Objective: This subject aims to aid the students to study the basics of real and reactive conventional compensators, understand the concept of flexible Ac transmission systems and the associated problems and review the static devices for series and shunt control. The course offers the study on the operation of controllers for enhancing the transmission capability and the operation, control and application of different FACTS devices and custom power devices.

UNIT I: COMPENSATORS

Introduction to FACTS controllers– Reactive power control-Reactive power, uncompensated Transmission line, reactive power compensation– Principles of conventional reactive power compensators-Synchronous condensers, saturated reactor, phase angle regulator and other controllers.

UNIT II: THYRISTOR CONTROLLED SHUNT COMPENSATOR

Objective of shunt compensation–Principle and operating characteristics of Thyristor Controlled Reactor(TCR)– Thyristor Switched Capacitor (TSC)– Static VAR Compensators (SVC)–SVC control system–SVC voltage regulator model–Transfer function and dynamic performance of SVC–Transient stability enhancement and power oscillation damping, mitigation of sub-synchronous resonance.

UNIT III: THYRISTOR CONTROLLED SERIES COMPENSATOR (TCSC)

Series compensation– Principles of operation of TCSC–Capability characteristics of TCSC–Modeling of TCSC– TCSC control system– enhancement of system damping– mitigation of sub-synchronous resonance.

UNIT IV: VSC BASED SHUNT AND SERIES COMPENSATOR

Static Synchronous Compensator (STATCOM)- Principle of operation- VI Characteristics-Harmonic performance –Steady state model– SSR mitigation-Static Synchronous Series Compensator(SSSC)-Principle of operation and characteristics of SSSC–control range and VA rating–capability to provide real power compensation–Immunity to sub-synchronous resonance – control scheme for SSSC.

UNIT V:UNI FIED POWER FLOW CONTROLLER

Basic operating principles–conventional transmission control capability of UPFC– Independent Real and reactive power flow control– control scheme for UPFC– Basic control system for P and Q control – dynamic performance

Total : 45 hours

TEXT BOOKS

1. Narain G.Hingorani and Laszlo Gyugyi,"Understanding FACTS concepts and technology of Flexible AC transmission systems"Edition2001,IEEE power Engineering society Sponsor, IEEE press, 2001.
2. R.Mohan Mathur and Rajiv K.Varma,"Thyristor-Based FACTS Controllers for Electrical Transmission Systems" ,Edition February 2002,IEEEpress-JohnWiley and Sons publications, 2002.

REFERENCE BOOKS

1. Vijay K.Sood,"HVDC and FACTS Controller: Application of Static Converters in power systems",IEEE Power Electronics and Power Systems series, Kluwer Academic publishers, Boston, First edition January2004.
2. Timothy John Eastham Miller," Reactive power control in Electric systems",John Wiley and sons, New York, 1982.
3. Yong Hua S ong and AllanT Johns,"Flexible AC Transmission System (FACTS)",IEEE Power Engineering Series-IEEE press, 1999.
4. K.R.Padiyar,"HVDC Power Transmission Systems Technology and System Interactions", New Age International (p) Limited, New Delhi, 2003.
5. EinarV.Larsen,JaunJ.Sanchez-Gasca and JoeH. Chow,"Concepts of design of FACTS Controllers to damp power swings",IEEE Transaction on PowerSystems,Vol.10,no.2, May1995.
6. GyugyiL, "Unified Power flow control concept for flexible AC transmission", IEEE Proceedings, vol. 139, no. 4, July1992.

EE E09 DIGITAL SYSTEM DESIGN USING VHDL

Objective: The objective of the course is to enable the students to design digital systems using VHDL. The various programmable logic devices, CAD tools, simulation aspects and chip configuration will be discussed first. The students will be taught with various VHDL concepts and programming. Then the design steps for combinational circuits using VHDL are introduced. Finally the course enables the students to design both synchronous and asynchronous sequential circuits.

UNIT I: IMPLEMENTATION TECHNOLOGY

Programmable logic devices- PLA, PAL, CPLD and FPGA– Custom chips–CAD Tools– design entry, synthesis, functional simulation, physical design, timing simulation, and chip configuration.

UNIT II: VHDL CONCEPTS

VHDL Terms – Behavioral Modeling– Sequential Processing – process statement- signal Variable assignment, sequential statements, and concurrent assignment problem – Data Types.

UNIT III: VHDL PROGRAMMING

Subprograms and Packages – Predefined Attributes – Configurations – VHDL Synthesis – constraints and attributes.

UNIT IV: COMBINATIONAL CIRCUIT DESIGN

Multiplexers–Decoders–Encoders–Code Converters–Arithmetic Comparison Circuits– VHDL for Combinational Circuits– Flip Flops– Registers – Counters – Simple Processor.

UNIT V: SEQUENTIAL CIRCUITS

Synchronous Sequential Circuits– Design steps-state assignment problem- Finite state machines using CAD tools. Asynchronous Sequential Circuits–synchronous behavior, analysis, synthesis, concept of stable and unstable states, hazards and design example– Vending machine controller.

Total : 45 hours

TEXT BOOKS

1. StephenBrownIZvonkoVranesic,“FundamentalsofDigitalLogicDesignwithVHDL”, Tata McGraw Hill, Second Edition, 2007
2. DouglasL.Perry,“VHDLProgrammingbyExample,TataMcGrawHill”,FourthEdition, 2002.

REFERENCE BOOKS

1. Charles H. Roth,Jr, “Digital Systems Design Using VHDL,”Thomson Learning, 2007
2. Ben Cohen,“VHDL Coding Stylesand methodologies”, Springer, 2ndEdition , 2005
3. Stainley Mazor,Patricia Langstraat,”A guide to VHDL”Springer, 2ndEdition , 2007

EE E10 HIGH VOLTAGE ENGINEERING

Objective: The objective of the course is to enable an engineering student to understand the concept to of insulation coordination between various electrical equipments in installation. The course describes the various methods of generating high voltages and currents and various techniques of measuring high voltages and currents. It details the study on break down phenomena in solid, liquid and gaseous dielectrics. The course explores the various test techniques and standards to test electrical equipments. At the end of the course, the student will be ableto conduct tests for various electrical equipments.

UNIT I: OVER VOLTAGES AND INSULATION COORDINATION

Causes of over voltages-lightning and switching over voltages- protection against over voltages-principles of insulation coordination.

UNIT II: GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS

Generation of high AC voltages- cascaded transformers-Generation of high DC voltages-Rectifier and Voltage doubler circuits, Cockroft Walton voltage multiplier circuit and its Qualitative analysis-Generation of impulse and switching surges –Marx circuit-generation of high impulse current. Tripping and control of impulse generators.

UNIT III: MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS

Measurement of AC,DC impulse and switching surges using sphere gaps, peak voltmeters, potential dividers and high speed CRO, op to Electronics method; Fiber optic method;

UNIT IV: ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS

Ionization processes- Town send & Streamer theory-the sparking voltage-Paschen's law-Time lag for break down –Break down in non-uniform fields and corona discharges- Conduction and breakdown in pure and commercial liquids and solids dielectrics.

UNITV: HIGH VOLTAGE TESTING PRACTICE

Indian Standards/IEC specification for testing, correction factor-high voltage testing of power Apparatus- Insulators, Bushings, Isolators, Circuit Breakers, Cables, Transformers and Surge Diverters.

Total : 45 hours

TEXT BOOKS

1. M.S.Naidu and N.Kamaraju,"High voltage Engineering",Third edition,TataMcGrawHill Publishing company, New Delhi, 2003.

REFERENCE BOOKS

1. E.Kuffel and W.S.Zaengel, "High voltage Engineering Fundamentals", Pergamon Press, Oxford,London, 2000.
2. Allan Green wood"Electrical Transients In power systems",Wiley Interscience,adivisionof JohnWiley and sons Inc., New York, 1971.
3. Dieterkind,"An Introduction to High voltage Experimental Techniques", WileyEastern Limited, New Delhi. 1978.
4. T.J.Gallagherand A.J.Pearmain, "High voltage Measurement Testingand Design", John Wiley and sons,NewYork, 1982.

EE E11 POWER SYSTEM ECONOMICS

Objective: This subject explores the structure of electrical tariff and the impact of depreciation on the power components. The fundamentals of minimizing the cost of generation sources to meet the power system load are discussed with the aid of computational methods.

UNIT I: ECONOMIC CONSIDERATIONS

Cost of electrical energy – Expressions for cost of electrical energy–Capital-interest– Depreciation-Different methods- Factors affecting cost of operation- Number and size of generating units-Importance of high load factor- Importance of power factor improvement- Most economical power factor- Meeting the KW demand on power stations- Power system tariffs – Regions and structure of Indian Power System.

UNIT II: ECONOMICDISPATCH

Modeling of Cost Rate Curves – Economic Dispatch Calculation - Losses neglected, with generator Real and Reactive power limits; Losses included- Losses of economy in incremental cost data - Problems - Generator Capability Curve – Effect of Ramping rates – Prohibited Operating Zones-Automatic Load dispatch in Power Systems.

UNIT III: ECONOMIC OPERATION

General loss formula- Evolution of incremental transmission loss rate- Method of calculation of loss coefficients– Systematic development of transmission loss formula- Transmission loss as a function of plant generation– Participation Factor- Non – Smooth Fuel Functions (Quadratic, Valve point loading, CCCP, Multiple Fuel) – Problems-Introduction to Artificial Intelligence Techniques for solving ELD problems.

UNIT IV: ECONOMIC CONTROL

Inter connected operation - Economic operation of hydro thermal power plants - Gradient approach–Newton's method-Modeling and solution approach to short term and long term Hydro-Thermal scheduling problem using Dynamic Programming.

UNIT V: OPTIMAL POWER FLOW AND FUNDAMENTALS OF MARKETS

Problem formulation - Cost minimization - Loss minimization - Solution using NLP and successive LP methods–Constraints-DC and AC OPF (Real and Reactive Power Dispatch)– Fundamentals of Markets–Efficiency and Equilibrium-Modeling of consumers and producers bids– Global welfare–Dead Loss.

Total : 45 hours

REFERENCES

1. Allen J Wood and BF Wollen berg, "Power Generation, Operation and Control", John Wiley &Sons, New York, 2010.

2. Hadi Saadat, “Power System Analysis”, Second Edition, Tata McGraw Hill Publishers, 2007.

3. Steven Stoft, “Power System Economics”, John Wiley &Sons, 2000.

4. Daniel S .Kirschen and GoranStrbac, “Power System Economics”, John Wiley &Sons, Ltd, 2004.

5. Scholarly Transaction Papers.

EE E12 RENEWABLE ENERGY SOURCES

Objective: In this course the students will learn about the concept of various renewable energy sources and instigate knowledge on the production strategies of renewable energy sources.

UNIT I: GENERAL

Conventional and non-conventional sources of energy- Energy reserves in India. Limitations of Conventional sources of energy-Energy efficiency-Energy conservation-Dispersed Generation.

UNIT II: SOLAR ENERGY AND APPLICATIONS

Solar radiation-Principles of solar energy collection-Types of collector–Characteristics and Principles of different types of collectors and their efficiencies, Solar Energy applications-water heaters, air heaters, solar cooling; solar drying and power generation -solar tower concept (solar plant) -solar pump,

UNIT III: WIND ENERGY

Energy from the wind-General theory of wind mills- Types of wind mills-performance of wind machines-wind power-efficiency. Merits and Limitations of Wind energy system-Modes of wind power generation.

UNIT IV: OCEAN&TIDAL ENERGY

Ocean and Tidal energy conversion-working principle of OTEC-Anderson closed cycle OTEC System - Application of Merits and demerits of ocean energy technologies. Tides- spring tide, neap tide, daily and monthly variation, Tidal range, Tidal Power-Types of tidal power plants, single basin& double basins chemes, main requirements in tidal power plants, energy storage, prospects of tidal power.

UNITV: BIO-ENERGY

Energy from Bio-mass-Biogas plants various types- Industrial wastes-Municipal waste- Burning plants –Energy from the Agricultural wastes Applications.

Total : 45 hours

TEXT BOOK:

1. D .P .Kothari, K .C .Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI, 2011.

REFERENCES

1. S.A.AbbasiandN.Abbasi,Renewable Energy Sources and Their Environmental Impact, PHI, 2001.
2. S.P. Sukhatme, solar. Energy; (Principles of thermal collection and storage), Tata Mc GrawHill Publishers, Fourth Print-February1989.
3. G.D. Rai, Solar Energy Utilization, Khanna Publishers .Second revised edition, 1984.

EE E13 DIGITAL CONTROL SYSTEM

Objective: The digital control system will deal with digital world. An engineering student will study digital signals and its representations in time domain and Z domain. The course introduces methods to obtain pulse transfer function. Various analyses of digital control systems using frequency domain method and state space method will be studied. The course details the different method so of analysis of stability of digital control system. At the end of the course an engineering student will be in a position to analyze and design digital control system.

UNIT I: INTRODUCTION

Introduction to discrete time control system-Pulse transfer function–general procedures for Obtaining pulse transfer functions- z domain equivalent to s-domain– correlation between time response and root location in the z plane–effect of pole zero configuration in z plane–transient response of sampled data systems– steady state error.

UNIT II: STATE VARIABLE TECHNIQUE

State equations of discrete time systems–solution of state equation-state transition matrix, its Properties –state space realization and state diagram–pulse transfer function from state equation - characteristic equation-Eigen values -Eigenvectors. Similarity transformation– transformation into various canonical forms.

UNIT III: CONTROLL ABILITY, OBSERVABILITY AND STABILITY

Controllability and observability of linear Time Invariant (LTI) discrete data systems–tests for control ability and observability-relationship between controllability, observability and pulse Transfer functions Stability of LTI discrete time systems-Jury's stability tests– Schur-Cohnst ability test- Lyapunov's stability analysis.

UNIT IV: CONTROLLER DESIGN (CLASSICAL APPROACH)

Transform of digital control systems–design specifications–bilinear transformation and design Procedure on the -plane–Lead, Lag and Lead-Lag compensators-Digital PID controller.

UNIT V: CONTROLLER DESIGN (STATE SPACE APPROACH)

State feedback-Design via pole placement–observer based state feedback–full and reduced order observers. Optimal state estimation– Kalman filter -Introduction to digital redesign.

Total : 45 hours

TEXTBOOKS

1. K. Ogata, "Discrete time control systems", 2ndedition, Pearson Edu., 2003.
2. Gene F. Franklin, J. David Powell, Michael L. Work man, "Digital control of Dynamic

systems", 3rdedition, Pearson Edu., 2002.

REFERENCEBOOKS

1. M. Gopal, "Digital Control and state variable methods", Tata McGraw hill, New Delhi, 2003.
2. Benjamin C. Kuo, „Digital Control systems",2nd Edition, Oxford University, 1997.

EE E14 EMBEDDED SYSTEM DESIGN

Objective: Embedded systems are built to suit a typical application ranging from small scale to very sophisticated systems. This course introduces various hardware and software concepts used to build embedded applications. The subject introduces the various building blocks of embedded systems and its features out line these lection of a processor and memory organization concepts. The students will learn bus organization, bus protocol sand use of standard expandable buses, different types of data transfer using interrupt sand DMA and concepts of real time operating systems, development and debugging tools.

UNIT I: INTRODUCTION TO EMBEDDED SYSTEM

Introduction to functional building blocks of embedded systems–Register, memory devices, ports, timer, interrupt controllers using circuit block diagram re presentation for each categories.

UNIT II: PROCESSOR AND MEMORY ORGANIZATION

Structural units in a processor-selection of processor & memory devices-shared memory; DMA-Interfacing processor, memory and I/O units; memory management–Cache mapping techniques, dynamical location-Fragmentation.

UNIT III: DEVICES & BUSES FOR DEVICES NETWORK

I/O devices-timer &counting devices- serial communication using I^2C, CAN, USB buses- Parallel communication using ISA, PCI ,PCI/X buses, arm bus- interfacing with devices/ports, device drivers in a system– Serial port & parallel port.

UNIT IV: I/O PROGRAMMING SCHEDULE MECHANISM

Intel I/O instruction–Transfer rate, latency; interrupt driven I/O- Non-maskable interrupts-Software interrupts, writing interrupt service routine in C & assembly languages-preventing interrupt overrun- disability interrupts- Scheduling–Thread states, pen ding threads, contexts witching, round robin scheduling, priority- based scheduling, assigning priorities, deadlock, watch dog timers.

UNIT V: REAL TIME OPERATING SYSTEM (RTOS)

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS–Interrupt handling, task scheduling; embedded system design issues in system development process–Action plan, use of target system, emulator, use of software tools.

Total : 45hours

TEXTBOOKS

1. Rajkamal, „Embedded System–Architecture, Programming ,Design ‟,TataMcGrawHill, 2003.
2. Daniel W. Lewis „Fundamentals of Embedded Software ‟,Prentice Hall of India, 2004.
3. Shibu .K, “Introduction to Embedded Systems”, Tata McGraw Hill, 2009

REFERENCE BOOKS

1. David E. Simon, „An Embedded Software Primer‟, Pearson Education, 2004.
2. FrankVahid,Embedded System Design–A Unified Hardware & Software Introduction‟, John Wiley, 2002.
3. SriramV.Iyer,Pankaj Gupte ,Embedded Real Time Systems Programming ‟,Tata McGraw Hill, 2004.
4. Steve Heath, „Embedded System Design ‟,II edition, Elsevier, 2003.

EE E15 HVDC TRANSMISSION

Objective: The objective of the course is to introduce HVDC transmission systems and it compares the features of HVDC and HVDC systems. The study on power converters which are the building block soft he HVDC systems will be deal tin respect of the performance metrics of the converters. The course also discusses HVDC faults and protection, reactive power management and elimination of harmonics. The students are enabled to study the multi terminal HVDC systems and their different types.

UNIT I: INTRODUCTION TO HIGH VOLTAGET RANSMISSION SYSTEMS

Introduction-Historical sketch-Comparison between AC and DC transmission-kinds of DC links – Planning and modern.

UNIT II: HVDC CONVERTERS

Three phase bridge converter-Simplified analysis, wave forms with and without overlap-Current And voltage relations- Input power factor- principles of control–Control characteristics– Constant ignition angle control– Constant current and extinction angle control-HVDC converters – twelve - higher pulse operation-introduction to modern converters

UNIT III: HVDC FAULTS AND PROTECTION

Converter faults , commutation failure, axis fire –Disturbance caused by over current and over Voltage –Protection against over current and over voltage–Surge arrestors smoothing reactors– Corona effects of DC line – Transient over voltages for DC line– Protection of DC links.

UNIT IV: REACTIVE POWER AND HARMONICS IN HVDC

Sources of reactive power-static VAR system–Reactive power control during transients– eneration of harmonics–Types and design of various AC filters, DC filters–interference- telephone-RI noise.

UNIT V: MULTI TERMINAL HVDC SYSTEMS

Types of MTDC system–Comparison of series and parallel MTDC system–HVDC insulation–DC line insulators – DC breakers – Characteristics and types of DC breakers.

Total : 45 hours

TEXTBOOKS

1. K.R.Padiyar,“HVDC Power Transmission Systems Technology and System Interactions”, New Age International (p) Limited, New Delhi, 2003.

2. Edward Wilson Kimbark,“ Direct current Transmission”, Wiley Inter science, Vol. I, New York, 1971.

REFERENCEBOOKS

1. Vijay K. Sood, “HVDC and FACTS Controller: Application of Static Converters in power systems”, IEEE Power Electronic sand Power Systems series, Kluwer Academic publishers, Boston, First edition January2004.
2. C. Adamson and N.G. Hingorani, “High voltage DC power Transmission”, Garraway Limited, England, 1960.
3. Mohan,Under land and Robbins, “Power Electronics Converters, Applications and Design, John Wiley & Son, Inc.,2003.
4. J. Arrialga, “HVDC Transmission”, Peter Peregrinus Ltd. , London, 1983.

EE E16 POWER SYSTEM RESTRUCTURING AND DEREGULATION

Objective: The objective of the course is to explore the students with the structure of electrical tariff and the impact of depreciation on the power components. The course offers an introduction to the architecture of power markets and discusses the technical challenges such as TTC and congestion management in the restructured power market .The fundamentals of minimizing the cost of generation sources to meet the power system load will be discussed with the aid of computational methods. Finally , the course offers a detail study on the current scenario of the Indian power market.

UNIT I: FUNDAMENTALS OF POWER MARKETS

Fundamental sand structure of Restructured Power Market–Wheeling–Market Power- Power exchange and pool markets-Independent System Operator (ISO)– components- role of ISO-Operating Experiences of Restructured Electricity Markets in various Countries (UK ,Australia, Europe, US, Asia).

UNIT II: TRANSMISSION CHALLENGES

Transmission expansion in the New Environment–Introduction–Role of transmission planning–Transmission Capacity–Total Transfer Capability (TTC) – Computational procedure - Margins–Available transfer capability (ATC)–Principles–Constraints-Methods to compute ATC.

UNIT III: CONGESTION MANAGEMENT AND ANCILLARY SERVICES

Concept of Congestion Management–Method store lieve the congestion-Inter and Intra zonal Congestion Management–Generation Rescheduling – Locational Marginal Pricing–Financial Transmission Right-Ancillary Services.

UNITIV: TRANSMISSION PRICING

Transmission pricing methods -Postage stamp-Contract path-MW-mile– MVAmile– Distribution Factor method–Tracing method- Short run marginal cost (SRMC)–Generator Ramping and Opportunity Costs.

UNITV: INDIAN POWER MARKET

Current Scenario– Regions–Salient features of Indian Electricity Act2003–Regulatory and Policy development in Indian power Sector–Availability based tariff–Necessity–Working Mechanism–Unscheduled Interchange Rate– Operation of Indian Power Exchange.

Total : 45 hours

REFERENCES:

1.M.Shahid ehpour and M.Alomoush,“Restructuring Electrical Power Systems”,Marcel Decker Inc., 2001.

2.M.Shahidehpour ,H.YaminandZ.Li,“Market Operations in Electric Power Systems ”,John Wiley&Sons,Inc., 2002.

3.Kankar Bhattacharya ,MathH.J.Bollenand JaapE. Daalder,“Operation of Restructured Power Systems”, Kluwer Academic Publishers, 2001.

4.LoiLeiLai,“Power system Restructuring and Regulation”, John Wiley sons, 2001.

5. Scholarly Transaction Papers, Utility and Power Exchange web sites.

EE E17 Optimization Techniques

Objective: Soft computing, as an engineering science emphasize different aspects of data analysis and the need for intuitive and interpretable models, which are tolerant to imprecision and uncertainty. Based on this,the course gives adequate exposure in the theory and applications of Linear programming, Non linear programming, Dynamic programming and the heuristic algorithms such as Genetic algorithm, Particle swarm optimization and its applications to engineering sciences.

UNIT I: LINEAR PROGRAMMING

Graphical method for two dimensional problems- central problem of linear programming – Definitions- simplex algorithm- phase I and phase II of simplex method. Simplex Multipliers- dual and primal- dual simplex method- transportation problem and its solution, assignment problem and its solution by Hungarian method- Karmarkar's method.

UNIT II: NON LINEAR PROGRAMMING

Introduction – unrestricted search– exhaustive search – interval halving method – Fibonacci method – random search method – uni variate method– pattern search methods – Hooke and Jeeves method – simplex method – gradient of a function, steepest descent method – conjugate gradient method.

UNIT III: DYNAMIC PROGRAMMING

Introduction - multistage decision processes- principles of optimality- computation procedures.

UNIT IV: EVOLUTIONARY ALGORITHMS

Evolution in nature- Fundamentals of Evolutionary algorithms- Working Principles of Genetic Algorithm- Evolutionary Strategy and Evolutionary Programming-Genetic Operators-Selection, Crossover and Mutation-Issues in GA implementation. Evolutionary algorithms – PSO – Simulation Annealing - Hybrid Approaches –Implementation issues.

UNIT V: MULTIOBJECTIVE OPTIMIZATION

Concept of pareto optimality-Conventional approaches for MOOP-Multi objective GA-

Fitness assignment-Sharing function.

Total : 45 hours

TEXT BOOKS:

1. Singiresu S Rao, “Engineering Optimization Theory and Practice”, New Age International, New Delhi, 2011.
2. Kalyanmoy Deb, “Multi objective optimization using Evolutionary Algorithms”, John Wileyand Sons, 2008.
3. Kalyanmoy Deb, “Optimization for Engineering Design”,Prentice hall of India first edition,1988.

REFERENCE BOOKS:

1. Sivanandam S. N., and Deepa S. N., “Principles of Soft Computing”, Wiley India (P) Ltd.,New Delhi, 2007
2. Kambo N S, “Mathematical Programming Techniques”, East West Press, New Delhi, 2005.
3. Hillier / Lieberman, “Introduction to Operations Research”, Tata McGraw Hill, New Delhi, 2012

EE E18 Power System Stability

Objective: This course aims to give basic knowledge about the dynamic mechanisms behind angle and voltage stability problems in electric power systems, including physical phenomena and Modeling issues. At the end of this course, Students will be able to analyze and understand the electromagnetic and electromechanical phenomena taking place around the synchronous generator. Will be able to solve the reactive power problems in power system

UNIT I: Introduction

Power system stability considerations – definitions-classification of stability - rotor angle and voltage stability - synchronous machine representation – classical model – load modeling concepts - modeling of excitation systems - modeling of prime movers -Mathematical Description of a Synchronous Machine-Basic equations of a synchronous machine - dq0 Transformation - per unit representation - equivalent circuits for direct and quadrature axes. Equations of motion - Swing Equation, H - constant calculation - Representation in system studies

UNIT II: Voltage stability

Definition-Power system stability classification- Physical phenomenon of Voltage collapse-Description-Time scales-Reactive power-system changes and Voltage collapse-maintaining variable voltage levels. Transmission System Aspects

UNIT III: Transmission System Stability

Single load infinite bus system-Maximum deliverable power-Lossless transmission-Maximum power-Power voltage relationships-Generator reactive power requirement-Instability mechanism. Effect of compensation:-Line series compensation-Shunt compensation-Static VAR compensator-VQ curves-Effect of adjustable transformer ratio.

UNIT IV: Generation Stability

Synchronous machine theory-Physical description-Mathematical description-dq0 transformation-Motion dynamics. Frequency and voltage controllers-Frequency control-automatic voltage regulators-Limiting devices affecting voltage stability-Over excitation limiters-Description-field current-Armature current limiters-Capability curves.

UNIT V: Load aspects and Power system stabilizer

Voltage dependence of loads - Load characteristics-Exponential load-Polynomial load. Saddle node bifurcation-Simple power system example (Static and Dynamic). Static voltage stability methods-Continuation power flow methods-P-V analysis - Modal analysis - Simple power system example -
State matrix including PSS -Small Signal Stability of Multi Machine Systems Special Techniques for analysis of very large systems - Analysis of Essentially Spontaneous oscillations in Power Systems (AESOPS) algorithms - Modified Arnoldi Method (MAM).

Total : 45 hours

Text Books

1.VanCutsen T and Vournas C, “Voltage Stability of Electric Power Systems”, Kluwer Academic Publishers, 1998.

2.Taylor C W, “Power System Voltage Stability”, McGraw Hill,Inc.,1994.

Reference books

1. KundurP ,“Power System Stability and Control”, McGraw Hill, Inc.,1995

2. RamanujamR, “Power System Dynamics-Analysis & Simulation”, PHI learning Private Limited.

3. Sauer P W &Pai M A,” Power System Dynamics and Stability”, Pearson, 2003

EE E19 SMART GRID

Objective: The course content is designed to study about smart grid technologies, different smart meters and advanced metering infrastructure. It is used to get familiarized with power quality management and communication protocols for the smart grid applications.

UNIT I: INTRODUCTION TO SMART GRID

Evolution of Electric Grid–Need for smart grid– Difference between conventional & smart grid – Overview of enabling technologies–International experience in smart grid deployment efforts– Smart grid road map for INDIA– smart grid architecture

UNIT II: WIDE AREA MONITORING SYSTEM

Fundamentals of synchro phasor technology – concept and benefits of wide area monitoring system– Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC)–Road Map for synchro phasor applications (NAPSI)–Operational experience and Blackout analysis using PMU

UNIT III: SMART METERS

Features and functions of smart meters– Functional specification–category of smart meters– AMR and AMI drivers and benefits– AMI protocol– Demand Side Integration-Peak load, Outage and Power Quality management

UNIT IV: INFORMATION AND COMMUNICATION TECHNOLOGY

Overview of smart grid communication system– Modulation and Demodulation techniques- Radio communication–Mobile communication–Power line communication– Optical fibre communication – Communication protocol for smart grid

UNIT V: SMART GRID APPLICATIONS

Overview and concept of renewable integration – role of protective relaying in smart grid– House Area Network– Advanced Energy Storage Technology - Flow battery– Fuel cell–SMES–Super capacitors– Plug–in Hybrid electric Vehicles– Cyber Security requirements–Smart grid information model

Total : 45 hours

REFERENCES

1. "Smart Grid Technology and Applications" by Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkins, John Wiley& Sons Publication, 2012.
2. "Smart Grid Primer", Published by Power Grid Corporation of India Limited, September 2013.
3. "Smart grid – integrating renewable, distributed and efficient energy", Fereidoon.P.sioshansi, Academic Press, 2011.

4. “Smart Grids: Infrastructure, Technology and Solutions”Edited by Stuart Borlase,CRC Press Publication, 2013.

EE E20 ADVANCED INSULATION SYSTEMS

Objective: This course aims to give basic knowledge about the insulation materials and breakdown of those materials at power frequency and by harmonics . Aslo it gives wide knowledge about nano composites and its breakdown characteristics. At the end of this course, Students will be able to understand the importance of insulation systems in the electric field and its electrical breakdown under various circumstances.

UNIT I: SOLID INSULATING SYSTEMS AND BREAKDOWN AT POWER FREQUENCY

Types of Solid insulating materials –Breakdown of Solid dielectrics: Intrinsic, electromechanical, Thermal breakdown – Breakdown due to treeing and tracking – Partial discharges in solids – Importance of adding fillers – Electrical properties of solid insulating materials with micro fillers, Breakdown under various electric field configurations.

UNIT II: BREAKDOWN OF SOLID INSULATING MATERIALS CAUSED BY HARMONICS

The voltage waveforms affecting winding insulation – Factors affect motors fed by Adjustable Speed Drives (ASD): Effect of voltage amplitude, PD erosion, polarity, rise time, pulse repetition frequency, duty cycle, PD inception voltage – Breakdown at high frequency high voltages and harmonics – Effect of space charges.

UNIT III: CONDITION MONITORING OF ELECTRICAL EQUIPMENT

Introduction to condition monitoring – Importance – Insulation reliability – Fault detection methods – Electrical aging of Insulation in Electrical machines and transformers – Electrical Analysis only – Partial Discharge monitoring – Life cycle – asset management

UNIT IV: INTRODUCTION TO NANO-COMPOSITES

Principle of Nano dielectrics – Processing of Nano Composites – chemistry and Physics of Interface region – 3 Core Model – Electrical Properties – Properties of Interface – Applications

UNIT V: BREAKDOWN OF NANO-COMPOSITES

Breakdown on nano-composites: Understanding of dielectric breakdown of polymer with various metal oxide nano fillers – effect of size, coatings – diagnostic methods – Effect of space charge – Partial Discharge Resistance to treeing.

Total : 45 hours

TEXT BOOKS

1. M.S. Naidu and V. Kamaraju, "High Voltage Engineering", Fifth Edition, Tata McGraw Hill, India, 2013
2. R.E. James & Q. Su,Condition Assessment of High Voltage Insulation in Power System Equipment, IET publications, 2008
3. D. Fabiani, "Accelerated degradation of ac-motor winding insulation due to voltage wave forms generated by adjustable speed drives," PhD thesis, Univ. Bologna, Italy, published by Gedit, Bologna, Italy, 2003.

REFERENCE BOOKS

1. N.H.Malik , A. A. Al-A rainy and M. I. Qureshi, "Electrical Insulation in Power Systems", Marcel Dekker, New York, 1998
2. K.C. Agrawal, Electrical Power Engineering, Reference and Application Handbook – Part 1, Newnes, 2001,
3. J. Keith Nelson, Dielectric Polymer Nano composites, Springer, 2010
4. Web Resources from www.ieeexplore.org/deis