Himachal Pradesh Technical University, Hamirpur (H.P.)

CURRICULUM(CBCS) ELECTRICAL ENGINEERING (3^{rd} to 8^{th} Semester)

Teaching and Examination Scheme

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H.P. Technical University
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SCHEME OF TEACHING AND EXAMINATION
B.TECH - ELECTRICAL ENGINEERING

SEMESTER – III

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	FC	MA-301	Probability and Statistics	2	2	0	3	40	60	100
2	FC	HS – 305	Industrial Economics and Management	3	0	0	3	40	60	100
3	PC	EE-301	Electrical Machine -1	3	1	0	4	40	60	100
4	PC	EE-302	Power Electronics-I	3	1	0	4	40	60	100
5	PC	EC-302	Digital Electronics	3	0	0	4	40	60	100
6	PC	EC-303	Network Analysis & Synthesis	3	0	0	3	40	60	100
7	OE	-	Open Elective-I	2	0	0	2	40	60	100
Labs:										
1	PC	EE-311	Electrical Machine -1 Lab	0	0	2	1	30	20	50
2	PC	EE-312	Power Electronics-I Lab	0	0	2	1	30	20	50
3	PC	EE-313	Digital Electronics Lab	0	0	2	1	30	20	50
			Total	17	5	6	24+2	370	480	850

Open Elective-I

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	HS-306	Sociology & Elements of IndianHistory for Engineers	2	0	0	2	40	60	100
2	OE	HS-307	German Language - I	2	0	0	2	40	60	100
3	OE	HS-308	French Language - I	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH - ELECTRICAL ENGINEERING

SEMESTER – IV

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	FC	MA-401	Optimization and Calculus of Variations	2	2	0	3	40	60	100
2	FC	HS-409	Human Values and Professional Ethics	2	2	0	3	40	60	100
3	PC	EE-401	Electrical Machine-II	3	1	0	4	40	60	100
4	PC	EE-402	Electrical Measurement & Measuring Instruments	3	1	0	4	40	60	100
5	PC	EE-403	Transmission & Distribution of Electrical Power	3	1	0	4	40	60	100
6	PC	EE-404	Communication Engineering	3	1	0	4	40	60	100
7	OE	-	Open Elective-II	2	0	0	2	40	60	100
Labs:										
1	PC	EE-411	Electrical Machine-II Lab	0	0	2	1	30	20	50
2	PC	EE-412	Electrical Measurement & Measuring Instruments Lab	0	0	2	1	30	20	50
3	MC	EE-413	Electrical Simulation Lab-I	0	0	3	2	30	20	50
			Total	16	8	7	26+2	370	480	850

Open Elective-II

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	HS-410	Law for Engineers	2	0	0	2	40	60	100
2	OE	HS-411	German Language - II	2	0	0	2	40	60	100
3	OE	HS-412	French Language - II	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH - ELECTRICAL ENGINEERING

SEMESTER – V

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PC	EE-501	Power Electronics-II	3	1	0	4	40	60	100
2	PC	EE-502	Linear Control System	3	1	0	4	40	60	100
3	PC	EE-503	Electrical Power Generation	3	0	0	3	40	60	100
4	PC	EE-504	High Voltage Engineering	2	2	0	3	40	60	100
5	PC	EE-505	Electromagnetic Field Theory	3	1	0	4	40	60	100
6	PC	EE-506	Flexible AC Transmission System	3	1	0	4	40	60	100
7	OE	-	Open Elective-III	2	0	0	2	40	60	100
Labs:										
1	PC	EE-511	Power Electronics-II Lab	0	0	2	1	30	20	50
2	PC	EE-512	Linear Control System Lab	0	0	2	1	30	20	50
3	MC	EE-513	Electrical Simulation Lab-II	0	0	2	1	30	20	50
			Total	18	4	6	25+2	370	480	850

Open Elective-III (For Students of Other Departments)

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	EE-507	Non-Conventional Electrical Power Generation	2	0	0	2	40	60	100
2	OE	EE-508	Energy Assessment & Audit	2	0	0	2	40	60	100
3	OE	EE-509	Robotics	2	0	0	2	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH - ELECTRICAL ENGINEERING

SEMESTER – VI

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	EE-601	Switchgear & Protection	3	0	0	3	40	60	100
2	PC	EE-602	Microprocessors & Applications	2	2	0	3	40	60	100
3	PC	EE-603	Power System Analysis	3	1	0	4	40	60	100
4	PC	EE-604	Electrical Drives	3	1	0	4	40	60	100
5	PC	EE-605	Digital Signal Processing	3	1	0	4	40	60	100
6.	PC	EE-606	Electrical Energy Utilization	3	0	0	3	40	60	100
7	PE	-	Programme Elective-I	3	0	0	3	40	60	100
Labs:										
1	PC	EE-611	Switchgear & Protection Lab	0	0	2	1	30	20	50
2	PC	EE-612	Microprocessors & Applications Lab	0	0	2	1	30	20	50
3	MC	EE-613	Seminar	0	0	2	1	50	50	100
			Total	18	3	6	24+3	370	480	850

PROGRAMME ELECTIVE - I

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	EE-607	Advanced Control System	3	0	0	3	40	60	100
2	PE	EE-608	Illumination Engineering	3	0	0	3	40	60	100
3	PE	EE-609	Neural Network & Fuzzy Logic	3	0	0	3	40	60	100

Industrial /Practical Training after VI^{th} Semester of six weeks duration

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SEMESTER – VII

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	EE-701	Energy Management	3	0	0	3	40	60	100
2	PC	EE-702	Electrical Power Quality	3	0	0	3	40	60	100
3	PC	EE-703	Non-conventional Electrical Power Generation	3	0	0	3	40	60	100
4	PC	EE-704	Electrical Machine Design	2	2	0	3	40	60	100
5	PE	-	Programme Elective-II	3	0	0	3	40	60	100
Labs:										
6	MC	EE-711	Project Work -I	0	0	4	2	50	50	100
7	PC	EE-712	Industrial /Practical Training(Viva-Voce)	0	0	0	2	50	50	100
8	MC	EE-713	Electrical Simulation Lab-III	0	0	2	1	30	20	50
			Total	12	0	10	17+3	290	360	650

PROGRAMME ELECTIVE-II

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	EE-705	Hydro Power Station Design	3	0	0	3	40	60	100
2	PE	EE-706	Testing & Commissioning of Electrical Equipments	3	0	0	3	40	60	100
3	PE	EE-707	High Voltage DC Transmission System	3	0	0	3	40	60	100

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SCHEME OF TEACHING AND EXAMINATION
B.TECH - ELECTRICAL ENGINEERING

SEMESTER – VIII

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PE		Programme Elective - III	3	0	0	3	40	60	100
2	PE		Programme Elective - IV	3	0	0	3	40	60	100
3	MC	EE-801	Project Work - II	0	0	16	8	50	50	100
			Total	6	0	16	8+6			
OR										
4	MC	EE-802	Industrial Project	0	0	16	8	50	50	100
			Total	0	0	16	8			

PROGRAMME ELECTIVE-III

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	EE-803	Power System Planning	3	0	0	3	40	60	100
2	PE	EE-804	Direct Energy Conversation	3	0	0	3	40	60	100
3	PE	EC-804	Digital Image Processing	3	0	0	3	40	60	100

PROGRAMME ELECTIVE-IV

S. N.	Cat.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	EE-806	Power System Stability	3	0	0	3	40	60	100
2	PE	EE-807	Optimization Techniques	3	0	0	3	40	60	100
3	PE	EE-808	Advanced Power Electronics	3	0	0	3	40	60	100

Note: Industrial Project of Fourmonths duration is to be carried out by the student exclusively in industry under the joint supervision of faculty advisers from institution as well as from the industry.

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SEMESTER-III
MA 301: PROBABILITY AND STATISTICS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Probability and Random Variables:** Introduction,Basic concepts–Sample space, Events, Counting sample space, Conditional Probability and Independence, Permutations and Combinations, Rules of Probability,Bayes' Theorem. Random Variables – Concept of Random Variable, Percentiles, Probability Distributions – Discrete & Continuous, Mean, Variance and Covariance of Random Variables, Chebychev's inequality.	6
II	**Standard Probability Distributions:** Discrete distributions - Uniform, Binomial, Multinomial, Hypergeometric, Poisson, Negative Binomial, Poission; Continuous distributions - Normal, Exponential, Gamma, Weibull and Beta distributions and their properties -Function of Random variables.	6
III	**Sampling Distributions:**Random sampling, Sampling Distributions of Means, Estimation, Properties of point estimators, Confidence interval, Maximum likelihood and Bayes estimators, Prediction intervals.	6
IV	**Testing of Hypothesis:**Sampling distributions – testing of hypothesis for mean, variance, proportions and differences using Normal,t, Chi-square and F distributions, tests for independence of attributes and Goodness of fit. **Linear Correlation and Regression Analysis:**Introduction, Linear Regression model, Regression coefficient, Lines of correlation, Rank correlation.	6

Text Books:

1. Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, Ninth Edition, New Delhi,1996.
2. Johnson. R. A., "Miller & Freund's Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000.
3. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", 5th Edition, 2011.

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Reference books:

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearson Education, Delhi, 2002.
2. Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.
3. S. M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists" 4th edition.

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HS 305: INDUSTRIAL ECONOMICS AND MANAGEMENT

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Engineering Economics** - Technical efficiency, economic efficiency - cost concepts:elements of costs, opportunity cost, sunk cost, private and social cost, marginal cost, marginal revenue and profit maximization. **Supply and Demand:**Determinants of demand, law of demand, determinants of supply, law of supply,market equilibrium - elasticity of demand - types of elasticity, factors affecting the price elasticity ofdemand. **National Income Concepts:** GDP and GNP, per capita income, methods of measuring national income. Inflation and deflation.	8
II	**Value Analysis** - Time value of money - interest formulae and their applications: single-paymentcompound amount 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, effective interest rate. **Investment Analysis:** Payback period—average annual rate of return, net present value; Internal rate of return criteria,price changes, risk and uncertainty.	8
III	**Principles of Management:** Evolution of management theory and functions of management organizational structure - principle and types - decision making - strategic, tactical & operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree. **Human Resource Management:** Basic concepts of job analysis, job evaluation, merit rating, wages,incentives, recruitment, training and industrial relations.	8
IV	**Financial Management**: Time value of money and comparison of alternative methods; costing – elements& components of cost, allocation of overheads, preparation of cost sheet, break even analysis - basics of accounting - principles of accounting, basic concepts of journal, ledger, trade, profit&loss account and balance sheet. **Marketing Management:** Basic concepts of marketing environment, marketing	8

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	mix, advertising and sales promotion. **Project Management:** Phases,organization, planning, estimating, planning using PERT & CPM.	

Text Books:

1. PanneerSelvam, R, "*Engineering Economics*", Prentice Hall of India Ltd, New Delhi.
2. Dwivedi, D.N., "*Managerial Economics, 7/E"*, Vikas Publishing House.

Reference Books:

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P., "*Engg. Economy 15/E*",Prentice Hall, New York, 2011.
2. Chan S. Park, "*Contemporary Engineering Economics*", Prentice Hall of India, 2002.
3. F. Mazda, *Engg.Management*, Addison Wesley, Longman Ltd., 1998.
4. O. P. Khanna, *Industrial Engg.andManagement*,DhanpatRai and Sons, Delhi, 2003.
5. P. Kotler, *Marketing Management, Analysis, Planning, Implementation and Control*,Prentice Hall, New Jersey, 2001.
6. VenkataRatnam C.S &SrivastvaB.K,*Personnel Management and Human Resources*, Tata McGraw Hill.
7. Prasanna Chandra, *Financial Management: Theory and Practice*, Tata McGraw Hill.
8. Bhattacharya A.K., *Principles and Practice of Cost Accounting*, Wheeler Publishing.
9. Weist and Levy, *A Management guide to PERT and CPM*, Prantice Hall of India.
10. Koontz H.,O'Donnel C.,&Weihrich H, *Essentials of Management*, McGraw Hill.

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EE-301: ELECTRICAL MACHINES-I

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Single-Phase Transformers**: principle of transformer operation,emf equation,voltage ratio and turns ratio,construction of single-phase transformers,ideal transformer,transformer on no load: phasor diagram and equivalent circuit, practical transformer:phasor diagram and equivalent circuit, voltage regulation, losses,open circuit, short circuit,back to backtest,transformer efficiency,condition for maximum efficiency,per unit transformer values,all day efficiency. Single-phase auto transformer, volt ampere relation, step up auto transformer, auto transformer efficiency, saving in conductor material, conversion of at wounding transformer to an auto transformer, advantages & disadvantages of auto transformer, applications of auto transformer.	8
II	**Three- phase Transformer:** Three-phase transformer,Comparison between three phase transformer bank and three phase transformer units,three-phase transformer construction,three-phase transformer groups,three-phase transformer connections, factors affecting the choice of connections,delta-delta connection,star-star connection,star-delta connection, delta-star connection, open delta connection, scott three-phase/ two phase connection, Comparison of Distribution and Power Transformer ,application of transformers Three winding transformers: equivalent circuit, determination of parameters,voltage regulation,polarity of the transformers,parallel operation of single-phase transformers and Three-phase transformers,wave shape of no load (exciting)current, in rush of magnetizing current, construction of current transformers and voltage transformers,transformer cooling.	8
III	**DC Machines-I: B**asic structure of electric machine, dc generator construction, equivalent circuit of dcmachine,type of dcmachine, emf equation of dc machine, armature reaction in dc generators, commutation, methods of improving commutation, demagnetizing and cross magnetizing ampere turns, characteristics of dc generator.	8

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IV	**DC Machine-II**: Motorprinciple, significance of back emf,equivalent circuit of a dcmotor,torque equation of dcmotor,types of dcmotor,characteristics of shunt,series &compound motors,speed control of dc motors, starting of dcmotors & starters, losses in dc machine,efficiency of a dc machine,testing of a dc machines,application of dc machines.	**8**

Recommended Books:

1. "ElectricalMachinery"byP.S.Bimbhra, KhannaPublishers,Delhi.
2. "Generalized theory of electrical machines" by P. S.Bimbhra,KhannaPublishers,Delhi.
3. "Electric Machinery"byFitzgerald&Kingsley,MGH.

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EE-302: POWER ELECTRONICS-I

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Power electronics devices**: Role of power electronics,construction and characteristics of powerdiode,power transistor, powerMOSFET, SCR,GTO,TRIAC&DIAC.SCR: two transistor model ,methodsofturn-on,R, RC and UJT firing circuit,commutation techniques,series and paralleloperation.	6
II	**Phase-controlled converters (ACtoDC converters):** One, two, three,six pulse converters, fullyandhalf controlled converters, load voltage waveforms with different types of loads, output voltage equations, continuousanddiscontinuousmodesofoperation,inputpowerfactorofconverter,reactivepowerdemand,effectof source inductance, introduction to four quadrant/dual converter.	10
III	**Cycloconverters (AC to AC converters):** basic principle of frequency conversion, types of cyclo converter, principle of operation of step up and step down cyclo converter,single-phase to single-phase cyclo converter with resistive and inductive load.Three-phase to single-phase cyclo converter,three-phase to three-phase cyclo converter,output voltage equation of cyclo converter	8
IV	**Choppers(DC to DC converter):** classification of choppers,principle of operation, steady state analysis of class-a choppers, stepup chopper:steady state analysis,current commutated and voltage commutated chopper,output voltage control techniques,one,two and fourquadrant choppers.	8

Recommended Books:

1. "PowerElectronics:Circuits, Devices&Applications"byM.H. Rashid, PrenticeHallofIndia Ltd,2004.
2. "PowerElectronics" byP.S.Bimbhra,KhannaPublishers,2006.
3. "PowerElectronics" byM.D. SinghandK.B. Khanchandani,TataMCGrawHillPub,2005.
4. "PowerElectronics:Converters,Applicationsand Design" byNedMohan,T.M.Undeland.

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EC-302: DIGITAL ELECTRONICS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Number system & codes:-**Binary arithmetic (Addition, Subtraction, Multiplication andDivision),Floatingpoint numbers.Diminished radix and radix compliments, BCD codes, 8421 code,Excess-3 code, Gray code, Error detection and correction: Parity code, Hamming code. **Logic Gates:-** Positive & negative logic, Tristate logic gates, Schmitt gates, Totem pole output and open collector output;Fan in and Fan out of logic gates, Buffer & trans-receivers, IEEE/ANSI standards symbols.	8
II	**Boolean algebra simplification techniques:-** Sum of products and product of sums simplification, NAND and NOR implementation, Incompletely specified functions, Ex-OR functions, The map method: Two, Three, Four and Fivevariablemaps;The tabulation method, Determination of prime implicants, Selection of essential primeimplicants. **Logic families:-**Classification of digital IC's, Significance & types, Characteristics parameters, TTL, ECL, CMOS logic families, NMOS & PMOS logic,Interfacing between TTL & CMOS.	9
III	**Combinational logic circuits:** Implementing combinational logic,Arithmetic circuits: Half adder, Full adder,Half substractor,Fullsubtractor; Multiplexer, Encoder, Demultiplexer & Decoder. **Flip flops:-** Introduction, S-R flip -flops, Level & edge triggered flip flops, JK flip-flop, D flip-flop, T flip-flop,Master slave JK flip-flop, Flip flop timing parameters & applications.	8
IV	**Shift Registers:-**Shift register, Ring counter, Universal shift registers, SISO, PISO, SIPO & PIPO. **Counters:-** Asynchronous ripple counter, Synchronous counter, Modulus of a counter,Binary ripple counter, Up& down, Decade counter. **Semiconductor Memories:-**Classification of memories,ROM, RAM, Static memory and Dynamic memory. Programmable logic arrays, Charged-coupled device memory.	8

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Text Books

1. Digital Electronics -Principle & Integrated circuits, Anil K Maini, Wiley India edition
2. Modern Digital Electronics, R.P.Jain, TMH
3. M. Morris Mano, Digital Design, Prentice Hall of India.

Reference Books

1. Digital Principle and Applications, Malvino and Leach, TMH
2. Digital Electronics, Kharate, Oxford University Press

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EC-303 : NETWORK ANALYSIS & SYNTHESIS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Analysis of coupled circuits and application of network theorem in AC circuits:** Active element conventions: Modelling of coupled circuits, Dot convention in coupled circuits; Network theorems in AC circuits:Thevenin's and Norton's theorems, Superposition theorem, Reciprocity and maximum power transfer theorem. **Graph theory and network equations:** Introduction and graph of a network, The incidence matrix, Fundamental cut set matrix, Fundamental tie set matrix and loop currents, Relation between various matrices. Network equilibrium equations: using KVL and KCL; Networks with mutual inductance, Duality.	9
II	**Application of Laplace transform in circuit analysis:** Review of Laplace transform: Definition of Laplace transform and its inverse, Laplace transform of basic functions, Properties of Laplace transform; Application of Laplace transforms in circuit analysis: Transformation of time domain circuit components to s- domain, Laplace transform to solution of network problems. **Transient response:** Transient response of R-L, R-C, R-L-C circuits(series combinations only) for DC and sinusoidal excitations.	9
III	**Two port networks:** Concept of two port networks, Classification of parameters: Open circuit and Short circuit parameters, Transmission and inverse transmission parameters, Hybrid and inverse hybrid parameters;Condition for reciprocity and symmetry, Inter-relationship between the parameters. Interconnection of two port networks: Series, Parallel,Cascade and series-parallel connection.T and pi representations.	8
IV	**Fundamentals of network synthesis:** Network functions, Concept of poles and zeros,Necessary condition of a stability of a network function. Hurwitz polynomial and its properties, Positive real function, Properties of positive real functions, Testing a positive real function, Synthesis of R-L, R-C and L-C driving point functions: Foster and Cauer forms.	8

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Text Books

1. Fundamentals of Electric circuits, Charles K Alexander, Matthew N O Sadiku, TMH
2. Circuit Theory -Analysis and synthesis, A. Charkrabarti,DhanpatRai& co.
3. Network analysis and synthesis, Franklin F. Kuc, PHI.

Reference Books

1. Networks and Systems, D.RoyChoudhury, New Age International.
2. Network Analysis, Van valkenberg, PHI
3. Engineering Circuit Analysis, WiliamHayt and Jack Kemmerly, TMH
4. Circuits and Networks- Analysis and Synthesis,A.Sudhakar and S.P.Shyam Mohan, TMH

HS 306: SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

- To familiarize the students with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues andproblems in Indian society.
- The enable the students to analyse critically the social processes of globalization, modernization and social change.
- To help the students imbibe such skills that will enable them to be better citizens and human beings.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to sociological concepts**: structure, system, organization, social institution, Culture social stratification (caste, class, gender, power). **Understanding social structure and social processes:** Perspectives of Marx and Weber.	6
II	**Political economy of Indian society:** Industrial, Urban, Agrarian and Tribal society. **Social change in contemporary India**: Modernization and globalization, Secularism and communalism.	6
III	**Introduction to Elements of Indian History:** What is history? ; History Sources - Archaeology, Numismatics, Epigraphy and Archival research. **Indian history and periodization:** evolution of urbanization process: first, second and third phase of urbanization.	6
IV	**From feudalism to colonialism:** The coming of British; Modernity and struggle for independence. **Issues and concerns in post-colonial India (upto 1991):** Issues and concerns in post-colonial India 2ndphase (LPG decade post 1991)	6

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Text Books:

1. Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan.
2. Giddens, A (2009), Sociology, Polity, 6thEdition.
3. Chandoke, Neera& Praveen Priyadarshi (2009), contemporary India: Economy, Society and Politics, Pearson.

Reference Books:

1. Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan.
2. Haralambos M, RM Heald, M Holborn (2000), Sociology, Collins.
3. Sharma R. S..(1965), Indian feudalism, Macmillan.
4. Gadgil, Madhab&RamchandraGuha(1999) - This Fissured Land: An Ecological Histry of India, OU Press.

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HS 307: GERMAN LANGUAGE – I

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVES:

- To read and write short, simple texts.
- To understand a dialogue between two native speakers and also take part in short, simple conversations using the skills acquired.
- To offers opportunities for students of engineering for higher studies, research and employment in Germany.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**WichtigeSprachhandlungen:** Phonetics – SichbegrüßenSich und anderevorstellenformell / informell - Zahlen von 1 bis 1 Milliarde - verstehen&sprechen. **Grammatik:** regelmäßigeVerbenimPräsens - "sein" und habenimPräsens - PersonalpronomenimNominativ.	6
II	**WichtigeSprachhandlungen:** TelefonNummernverstehen und sprechenUhrzeitenverstehen und sagenVerneinung "nicht und kein" (formell und informell) **Grammatik**: Wortstellung – Aussagesatz – W-Frage und Satzfrage (Ja/NeinFrage) Nomenbuchstabieren und notierenbestimmter und unbestimmterArtikelundNegativartikelim Nom. &Akkusativ	6
III	**WichtigeSprachhandlungen:** TageszeitenverstehenundüberTerminesprechen-Verabredungenverstehen - AufgabenimHaushaltverstehen **Grammatik:** PersonalpronomenimAkkusativ und Dativ - W-Fragen "wie, wer, wohin,wo, was usw.-GenitivbeiPersonennamen - ModalverbenimPräsens "können, müssen,möchten"	6
IV	**WichtigeSprachhandlungen:** Sichaustauschen, was man kann, muss – BezeichnungenLebensmittel – Mengenangabenverstehen – PreiseverstehenundEinkaufzettelschreiben	6

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	Grammatik: Wortstellung in SätzenmitModalverben – Konnektor ”und” – “noch”-kein-------mehr – “wieviel, wieviele, wie alt, wielange” – PossessivartikelimNominativ.	
V	**WichtigeSprachhandlungen:** Freizeitanzeigenverstehen – HobbysundSportartenAnzeigenfürFreizeitpartnerschreibenbzw. daraufantworten –Vorlieben und Abneigungenausdrucken **Grammatik:**VerbenmitVokalwechselimPräsens – ModalverbenimPräsens“dürfen, wollen und mögen - “haben und sein” imPräteritum – regelmäßigeVerbenimPerfekt – Konnektoren “denn, oder, aber.	**6**

Text Book

1. Studio d A1. Deutsch alsFremdsprache with CD.(Kursbuch und Sprachtraining).

References

1. German for Dummies
2. Schulz Griesbach

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HS 308: FRENCH LANGUAGE - I

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVES:

- To read and write short, simple texts.
- To understand a dialogue between two native speakers and also take part in short, simple conversations using the skills acquired.
- To offers opportunities for students of engineering for higher studies, research and employment in French.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Grammar and Vocabulary:** Usage of the French verb "se presenter", a verbof self- introduction and how to greet a person- "saluer". **Listening and Speaking:** The authentic sounds of the letters of the Frenchalphabet and the accents that play a vital role in the pronunciation of thewords. **Writing:** Correct spellings of French scientific and technical vocabulary. **Reading:** Reading of the text and comprehension – answering questions.	6
II	**Grammar and Vocabulary:** Definite articles, "prepositions de lieu" subjectpronouns. **Listening and Speaking:**Pronunciation of words like Isabelle, presentezandla liaison – vousetes, vousappelez and role play of introducing each other –group activity. **Writing:** Particulars in filling an enrolment / registration form. **Reading Comprehension:** reading a text of a famous scientist and answeringquestions.	6
III	**Grammar and Vocabulary:**Verb of possession "avoir' and 1st group verbs"er", possessive adjectives and pronouns of insistence- moi, lui..andnumbers from 0 to 20. **Listening and Speaking: N**asal sounds of the words like feminine, ceinture,parfum and how to ask simple questions on one's name, age, nationality,address mail id and telephone number. **Writing:** Conjugations of first group verbs and paragraph writing on self – introduction and introducing a third person. **Reading Comprehension:** reading a text that speaks of one's profile andanswering questions	6

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IV	**Grammar and Vocabulary:** Negative sentences, numbers from 20 to 69, verb"aimer"and seasons of the year and leisure activities. **Listening and Speaking:** To express one's likes and dislikes and to talk of one's pastime activities (sports activities), je fais du ping-pong and nasal sounds of words – janvier, champagne. **Writing-**Conjugations of the irregular verbs: faire and savoir and their usage.Paragraph writing on one's leisure activity- (passé temps favori). **Reading:** a text on seasons and leisure activities – answering questions.	**6**
V	**Grammar and Vocabulary:** les verbes de direction- to ask one's way and togive directions, verbes- pouvoir and vouloir and 2nd group verbs, a droite, lapremiere a gauche and vocabulary relating to accommodation. **Listening and Speaking:**To read and understand the metro map and hence to give one directions – dialogue between two people. **Writing:**Paragraph writing describing the accommodation using the different prepositions like en face de, derriere- to locate. **Reading Comprehension:**A text / a dialogue between two on location and directions- ouest la poste/ la pharmacie, la bibliotheque?.....	**6**

Text Book
1. Tech French

References
1. French for Dummies.
2. French made easy-Goyal publishers
3. Panorama

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EE-311: ELECTRICAL MACHINES-I LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

LISTOFEXPERIMENTS:

TRANSFORMERS

1. Tofindturnsratio&polarityof single-phasetransformer.
2. Toperformopen&short-circuittestsonsingle-phasetransformer.
3. Toper form Sumpner's(BacktoBack) testontwoidentical1-Φ transformers.
4. Paralleloperationof twosingle-phasetransformers&tostudytheloadsharedbyeachtransformer.
5. To convertthree-phasetoTwo-phaseByScott-connectionof transformers.

DCMACHINES

6. Toplotthemagnetizingcharacteristicsofadcgeneratorunningatratedspeed.
7. Toobtainandplottheexternalcharacteristicsofadcshuntgenerators&todeducetheinternal characteristics from the above.
8. Toper form load test on DC shunt generator.
9. SpeedcontrolofDCshuntmotor.
10. Swinburne'stestsofDCshuntmotor.
11. ToobtainandplotthecharacteristicsofDCseriesmotor.
12. ToperformloadtestonDCseriesmotor.

NOTE: Atleasteightexperiments aretobeperformedinthesemesterfromtheabove list.

Recommended Books:

1. "Experimentation and viva voce on electrical machines" by V.N.Mittal&A.Mittal, Standard Publications.

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EE-312: POWER ELECTRONICS-I LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

LISTOFEXPERIMENTS:

1.Experimenttostudycharacteristicsofdiode, SCRand TRIAC.
2.Experimenttostudycharacteristicsoftransistorand MOSFET.
3.ExperimenttostudyRand R-Cfiringcircuits.
4.ExperimenttostudyUJTfiringcircuit.
5.ExperimenttostudyACphase control.
6.Tostudythree-phasefull-waveuncontrolledrectifieroperationwithRandR-Lloadand observe its input/output Wave form.
7.Experimenttostudydcchopper.
8.Experimenttostudysingle-phasecycloconvertercharacteristics.
9.Tostudysingle-phasefullwavecontrolledrectifierusingSCRandUJTwithRandR-Lloadand observeitsinput/outputWaveformwithandwithoutfreewheeling(commutating)diode.
10.ExperimenttostudyLamp-DimmercircuitusingDiac&Triacwith lampload.

Note: Atleasteightexperimentshavetobeperformedinthesemesterfromtheabovelist.

EE-313: DIGITAL ELECTRONICS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

LISTOFEXPERIMENTS

1. Verify truth tables of AND,OR, NOT, NAND,NOR and XOR gates.
2. Implement(i)half adder(ii) full adder using AND–OR gates.
3. Implement full adder using NAND gates as two level realizations.
4. Implement full subtractor using 8 to1multiplexer.
5. Verify truth tables ofRS &JK flip flops and convert JKflip flops into D type & T type flip flops.
6. Use 555 timer as(i) monostable(ii) as table multivibrator.
7. (a) Use of 4-bit shift register for shift left and shift right operations.
   (b) Use4-bit shift register as a ring counter.
8. Implement mod–10 counter and draw its output wave forms.

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9. Implement 4-bit DAC using binary weighted resistance technique/R-2R ladder network technique.
10. Implement8–bit ADC using IC(ADC0800/0801).
11. a) Implement(i)Single level clipping circuit (ii)Two level clipping circuit.
    b) Implement clamping circuit to clamp,at peak +ve voltage/peak –ve voltage of aninput signal.

ADDITIONAL EXERCISES:

1. Construct bounce less witch.
2. Construct a pulser of1Hzand10Hz,1kHz and manual.
3. Construct logic state detector.
4. Construct op to–sensor based.
   a. Measurement rotational speed of motor.
   b. Measurement time elapse between two events. c.
   Measurement of linear velocity.
   d. Measurement of acceleration.
5. Construct a memory using TTL Circuits. Read and write data on to a memory from bus.
6. Construct a security latch that can be operated by an identity card.

Note: At least eight experiments have to be performed in the semester from the above list.

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SEMESTER IV

MA 401: OPTIMIZATION AND CALCULUS OF VARIATIONS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE OBJECTIVES:

The objective of this course is to present different methods of solving optimization problems in the threeareas of linear programming, nonlinear programming, and classical calculus of variations.In addition to theoretical treatments, there will be some introduction tonumerical methodsfor optimization problems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** A survey of some simplified examples of common real world situations leading to optimization problems, basic formulation and theory of optimization problems. **Linear programming:** Linear programming (optimization of linear functions	6

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	subject tolinear constraints): basic theory; simplex method; duality, practical techniques.	
II	**Linear programming:** Basic LPP - solution techniques (Simplex, Artificial Basis), Complimentary Slackness Theorem,Fundamental theorem of Duality,degenerate solutions, cycling; Applications - elements of dynamic programming including Hamiltonian, Bellman'soptimality principle. **Transportation and Assignment Problems:** Solution of a balanced transportation problem, degeneracy in transportation problems and alternate solutions, Mathematical problems in formulation of assignment problems.	**6**
III	**Nonlinear programming:** Nonlinear programming (optimization of nonlinear functions subject to constraints) with Lagrange multipliers, Karush-Kuhn-Tucker optimality conditions, convexity, duality. **Approximation methods for nonlinear programming:** Line search methods, gradient methods, conjugate gradient methods; Networking techniques – PERT and CPM.	
IV	**Calculus of Variations:**Basic definitions -functionals, extremum, variations, function spaces; Necessary conditions for an extremum, Euler-Lagrange Equation, convexity and it's role in minimization, minimization under constraints; Existence and nonexistence of minimizers;Applications - Isoperimetric problems, Geodesics on the surface.	

Text Books:

1. C. B. Gupta, "Optimization Techniques in Operation Research," I. K. InternationalPublishing House Pvt. Ltd.
2. A. S. Gupta, Calculus of Variations and Applications, PHI Prantice hall India.
3. Mukesh Kumar Singh, "Calculus Of Variations" Krishna Prakashan Media (P) Ltd.
4. J. K. Sharma, Operations Research – Problems and Solutions, Macmillian Pub.

Reference books:

1. I. M.Gelf and S. V. Fomin, "Calculus of Variations" Dover Publications IncMineola,New York.
2. Purna Chand Biswal, "Optimization in Engineering, Scitech Publications India Pvt. Ltd.
3. B. S. GREWAL, Higher Engineering Mathematics, Krishna Publications.
4. G. Hadly, Linear Programming, Narosa Publishing House.
5. KantiSwarup, P. K. Gupta and Manmohan, "Operations Research," Sultan Chand & Sons.

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HS 409: HUMAN VALUES AND PROFESSIONAL ETHICS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3 hrs

COURSE OBJECTIVES:

- To enable students to explore the purpose of value education.
- To understand the purpose of harmony with oneself, family, society and nature.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction –Need and Basic Guidelines** 1. Understanding the need , basic guidelines, content and process of value Education 2. Self-Exploration – purpose, content and process, 'Natural Acceptance' and Experiential Validation – as the mechanism for self-explanation.	6

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II	**Process for Value Education** 1. Continuous Happiness and Prosperity – A look at basic Human Aspirations. 2. Right Understanding, Relationship and Physical Facilities – basic requirements for fulfillment of aspirations of every human being with their correct priority 3. Understanding Happiness and prosperity – A critical appraisal of the current scenario. 4. Method to fulfill the human aspirations; understanding and living in harmony at various levels	7
III	**Harmony in Human Beings** 1. Understanding human being as a co-existence of the self and the body. 2. Understanding the needs of Self ('I') and 'Body' – Sukh and Suvidha. 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)	7
IV	**Harmony in Myself and body** 1. Understanding the characteristics and activities of 'I' and harmony in 'I' 2. Understanding the harmony of I with the Body: Sanyam and Swasthya: correct appraisal of Physical needs, meaning of Prosperity in detail.	6
V	**Harmony in Family, Society and Nature** 1. Understanding harmony in the family, society and nature. 2. Understanding values in human relationship; meaning of Nyaya and Program for its fulfillment to ensure Ubhay-tripti. 3. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.	6

Text Books

1. R R Gaur, RSangal and GP Bagaria, A Foundation Course in value Education, Published by Excel Books (2009).
2. R R Gaur, R Sangal and G P Bagaria, Teacher's Manual (English), 2009.

Reference Books

1. E.F. Schumacher, Small is Beautiful; a study of economics as if people mattered, Blond & Briggs, Bratain, 1973.
2. PL Dhar, RR Gaur, Science and Humanism, common wealth publishers, 1990.
3. A.N. Tripathy, Human values, New Age International Publishers, 2003.

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4. E.G. Seebauer& Robert, L BERRY, Foundational of Ethics for Scientists &Engineers, Oxford University Press, 2000.
5. M. Govindrajran, S.Natrajan& V.S. Senthi Kumar, Engineering Ethics (including human Values), Eastern Economy Edition, Prentice hall of India Ltd.
6. B.L. Bajpai, 2004, Indian Ethos and Modern Management, New Royal book Co; Lucknow, 2004, Reprinted 2008.

EE-401: ELECTRICAL MACHINES-II

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Three-phase Induction machine:** Constructional features, Rotating magnetic field, production of torque, phasor diagram, equivalent circuit, performance analysis, torque slip characteristics, no-load and blocked rotor test, load test, effect of rotor resistance, induction Generator. Deep bar and double cage induction motor, starting method of squirrel cage and wound rotor induction motor, various methods of speed control of squirrel cage and wound rotor induction motor.	8
II	**Single phase induction motors:** Introduction, production of rotating fields, principle, double revolving field theory,rotor slip, equivalent circuit, determination of equivalent circuit parameters, starting methods, types of single-phase induction motors, characteristics and applications of single-phase motors.	7

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III	**Synchronous generators**: Introduction, construction of 3-phase synchronous machines, emf equation, armature winding, coil span factor, distribution factor, actual voltage generated, armature leakage reactance, armature reaction, synchronous impedance, equivalent circuit & Phasor diagram, voltage regulation,measurement of synchronous impedance. Two reaction theory,salient pole synchronous machine- two reaction model, torque angle characteristic of salient pole synchronous machine,maximum reactive power for a synchronous generator, determination of Xdand Xq,parallel operation of alternators, synchronizing power and synchronizing torque coefficient,transient conditions of alternators.	**8**
IV	**Synchronous motors:** Introduction, construction, principle of operation, main features,equivalent circuit and phasor diagram of a cylindrical rotor synchronous motor, different orquesin synchronous motor, effect of varying excitation and loadchanges,synchronous motor Vcurves and inverted Vcurves, starting ofsynchronous motors,hunting,synchronous condenser,applications of synchronous motors.	**7**

Recommended Books:

1. "Electrical Machinery"by P.S.Bimbhra,Khanna Publishers,Delhi.
2. "Generalized theory of electrical machines"byP.S. Bimbhra,Khanna Publishers,Delhi.
3. "Electric Machinery"byFitzgerald&Kingsley,MGH.

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EE-402: ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Measuring System fundamentals**: Classification of Instruments (Absolute &Secondary Instruments; Indicating, Recording &Integrating instruments; Based upon Principle of operation),three forces in Electromechanical Indicating Instrument (Deflecting,controlling &damping forces),Comparison between gravity &spring controls, Comparison of damping methods &their suitability. **Units Standards & Errors**: S.Iunits, Absolute standards (International, Primary. Secondary &Working Standards), True Value, Errors (Gross, Systematic, Random) ;Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution &threshold). **Transducers:** Classification of transducers (Active, Passive, Primary & secondary), Basic construction and principle of LVDT ,Strain gauge and Thermocouple transducers.	8
II	**Measuring instruments**: Construction, operating principle, Torque equation, Shape of scale, use as Ammeter or As Voltmeter (Extension of Range), Use on AC/DC or both, Advantages & disadvantages, Errors (Both on AC/DC) of PMMC types, Electrodynamics Type, Moving iron type (attraction, repulsion & combined types), Hotwire type,Induction type & Electrostatic type Instruments. **Wattmeter & Energy Meters**: Construction, operating principle, Torque equation, Shape of scale, Errors, Advantages &Disadvantages of Electrodynamics &Induction type Wattmeter &single phase induction type Energy meter, Compensation & Creep in energy meter.	8
III	**Power Factor & Frequency Meters**: Construction, operation, principle, Torque equation, advantages & disadvantages of Single-phase power factor meters (Electrodynamics &Moving Iron types) & Frequency meters (Electrical Resonance ,Ferro dynamic & Electro dynamic types). **Resistance Measurement** Low &High Resistance Measurements: Limitations of Wheatstone bridge; Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megohm bridge & Meggar.	8
IV	**A.C. Bridges:** General balance equation, Circuit diagram, Phasor diagram,	8

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	advantages, disadvantages, applications of Maxwell's inductance, inductance-capacitance, Hays, Anderson, Owens, De-Sauty's,Schering & Weinsbridges, Shielding & earthing.	

Recommended books

1. A Course in Elect.& Electronic Measurement & Instrumentation byA.KSawhney;KhannaPub.
2. Electronic & Elect. Measurement & Instrumentation by J.B.Gupta;Kataria&Sons.
3. Electrical Measurements by E.W.Golding
4. Electronic Measurement and Measuring technique by W.D. Cooper&A.D.Helfrick.
5. Measuring Systems by E.O. Doeblin;TMHPublishers.

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EE-403: TRANSMISSION &DISTRIBUTION OF ELECTRICAL POWER

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Structure of a power system, indoor and outdoor substations, equipment for substation layout, auxiliary supply. **Distribution Systems:** Radial, ring mains and network distribution system, comparison of various types of Supply systems (overhead).	8
II	**Transmission Lines Parameters:** Introduction: inductance of a conductor due to internal flux and external flux, inductance of a single phase two-wire line,inductance of three phase line,capacitance of three phase line,charging current due to capacitance,skin effect,Ferranti effect, proximity effect. **Performance of Lines:** Models of short, medium and long transmission lines, performance of transmission lines, capacityof synchronous condenser,tunedlines, voltage control.	8
III	**Corona:** Corona phenomenon, formation, Calculation of potential gradient, corona loss, factor effecting corona, method of reducing corona. **Insulators:** Types of insulator and application, voltage distribution over insulator string, Method of equalizing the potential gradient, String efficiency,insulator failures,testing of the insulators.	8
IV	**Mechanical Design:** Sag and stress calculations, effect of ice and wind, string chart, line supports, conductor material, dampers. **Cables:** Types of cables, construction of cables, grading of cables, capacitance, ratings, power factor in cables, thermal characteristics and applications.	8

Recommended Books:

1. Power System Engg:byI.J.Nagrathand D.P Kothari (TMH)
2. A CourseinElectrical Power by Gupta, Soni&Bhatnagar(DhanpatRai&Sons).
3. Power system by AqshafHussain, DhanpatRai, Delhi

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4. Elements of power system analysis by W.D.Stevenson(MGH)
5. Electric Power by S.L.UppaI(KhannaPub.)
6. Electrical power by J.B.Gupta(S.K.Kataria&Sons).
7. Power System Engineering by B.R. Gupta.
8. Electric Power System by B.M.Weedy,JohnWiley &Sons.
9. Transmission &Distribution o fElectricalEngineering by H.Cotton.

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EE-404: COMMUNICATION ENGINEERING

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3 hrs

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Frequency Bands And Signals:** Various frequency bands used for communication and their special features, Need for wireless communication,Types of communication based on modulation systems,types of various signals. **Modulation Techniques:** Introduction to AM, FM, PM, PCM, PPM, DSBSC, SSB,, vestigial side band system. Comparison between analogand digital modulation, frequency division multiplexing and time division multiplexing.	8
II	**Amplitude Modulation:** Representations of AM, Frequency spectrum of AM Waves, need and descriptions of SSB, suppression of carrier. **AM Transmitters:** generation of AM, Low Level and High-level modulation, Comparison of levels, AM transmitter block diagram, collector class C modulator, and Base modulator, DSBS/C Modulator. **AM Receiver:** Tuned radio frequency (TRF)receiver, Super heterodyne receiver, RF section and characteristics, mixers, frequency changing and tracking, IF rejection and IF amplifiers, detection and automatic gain control(AGC),AM receiver characteristics.	9
III	**Frequency Modulation:** Mathematical representation of FM, Frequency spectrum of the FM waves, wideband and narrow band FM. **FM Transmitters:** Basic requirements and generation of FM, FM Modulation methods: Direct methods, varacter diode methods, FET reactance modulator, Transistor reactance modulation, Pre-emphasis,direct FM modulator, AFM in reactance modulation, RC Phase Shift modulation, Armstrong FM systems. **FM Receiver:** Limiters, single and double tuned demodulator, balanced slope detector, fosterseely of phase discriminator, de-emphasis, ratiodetector, blockof FM receiver, RFamplifiers, FMreceiver characteristics.	8
IV	**Digital Modulation:** Broad overview of PCM,DM, and ADM.Review of sampling, flattop sampling, quantization, Analogto digital conversion,overview of performance of anlong modulations chemein presence of noise. Digital modulation techniques (ASK,FSK, BPSK,QPSK,M-ary PSK). An introduction to satellite Communication.	9

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Recommended Books:

1.Electroniccommunications systems by Kennedy/TMH
2. Communications systems by Taub&Schilling/TMH
3. Communication systems by Simon Haykins/John Wiley & sons
4. Communication systems by Bruce Carlson
5. Communication systems by Singh &Sapre/TMH

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HS 410: LAW FOR ENGINEERS

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs

COURSE OBJECTIVE:

- To familiarize students (Prospective engineers) with elementary knowledge of laws that would be of utility in their profession.
- To familiarize students with the constitution of India and laws in new areas viz. IPR, ADR, Human Rights, Right to Information, Corporate law, Law relating Elections and Gender Studies.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Constitutional Law:** Nature of Indian Constitution (features), fundamental rights, duties and directive Principles of State Policy (DPSP's), forms of Governments, structure of Government of India, role and responsibility of executive, legislature/parliament and judiciary, nature of Indian federal system, center state and relations. Basic structure of the Indian constitution, basic features of the Indian, constitutional amendments - GolakNath, KeshwanandaBharti, Maneka Gandhi (1978) and S.R. Bommai case (1994), (floor test).	6
II	**Law of contract:** General principles of Indian Contract Act, 1862, kinds of Government contracts and dispute settlement, standard and printed form of contract, essential elements of valid contract proposal, acceptance communication and revocation thereof, relevance of time in contractual obligation. Main objectives of Arbitrates and Conciliation Act-1996, tort and law of tort, general principles of tort law, classifications of torts: property vs. person.	6
III	**Administrative Law:** Evolution, nature and its scope, conceptual objection against growth of administrative rule of law and separation of power, clarification of administrative actions, judicial review of administrative actions, exclusion of judicial review and concept of "Ombudsman";Right to Information Act, 2005 (Sub Section 1 - 20) **Environmental Law:** Definition, meaning and its nature, environmental (Protection) Act-1986, Water (Preservation and Control of Pollution) Act-1974,	6

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	Air (Prevention and Control of Pollution) Act-1981; Environmental pollution, overall remedies and procedures.	
IV	**Human Rights:** Legality of human rights, universal declaration of human rights, 1948, difference between civil and political rights, individual and human rights - human rights of child, weaker section of society, prisoners, and refugees, International Human Rights Commission.	**6**

Text Books:

1. D.D. Basu, ***Shorter Constitution of India***, Prentice Hall of India, (1996)
2. MeenaRao, ***Fundamental concepts in Law of Contract***, 3rd Edn. Professional Offset, (2006)
3. H.O.Agarwal,***International Law and Human Rights***, Central Law Publications, (2008)

Reference Books:

1. H.M. Seervai, ***Constitutional Law of India***, Tripathi Publications, (1993).
2. S.K. Kapur, ***Human Rights under International Law and Indian Law,***Central Law Agency, (2001)
3. NeelimaChandiramani, ***The Law of Contract: An Outline***, 2nd Edn. Avinash Publications Mum, (2000)
4. Avtarsingh, ***Law of Contract***, Eastern Book Co., (2002).
5. Anson W.R.(1979), ***Law of Contract***, Oxford University Press

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HS 411: GERMAN LANGUAGE – II

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs
Prerequisite							
HS 302: GERMAN LANGUAGE - I							

COURSE OBJECTIVES:

- To enable the students to speak and understand about most of the activitiesin the day to day life.
- The students will be able to narrate their experiences in Past Tense.
- The students will be able to understand and communicate even with German Nationals.
- By the end of Phase – II the students will have a reasonable level of conversational skills.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**WichtigeSprachhandlungen:**Zimmersuche, Möbel **Grammatik**: VerbenmittrennbarenVorsilbenimPräsens und Perfekt. VerbenmittrennbarenVorsilben und ModalverbenimPräsens.VerbenmituntrennbarenVorsilbenimPerfekt.UnregelmäßigeundgemischteVerbenimPerfekt.	6
II	**WichtigeSprachhandlungen**: Kleidung ,Farben, Materialien. **Grammatik:** formelleImperativsätzemit "Sie" informelleImperativsätzeVorschlägemit "wir" – "sollen/wollenwir" - Sollich? Modalpartikeln "doch""mal" "doch mal.	6
III	**WichtigeSprachhandlungen:**Sehenswürdigkeite (Prater, BrandenburgerTör,Kolossium, Eifeltürm). **Grammatik:**OrtsangabenmitAkk. UndDativ "alle","man" Indefinitepronomen"etwas",	6

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	"nichts".	
IV	**WichtigeSprachhandlungen:** Essen und TrinkenimRestaurant,Partyvorbereitung und Feier. **Grammatik:** NomenausAdjektivennach "etwas"und "nichts" NomenausdemInfinitiv von Verben, zusammegesetzteNomen und ihreArtikel. AdjektiveimNom.undAkk.nachunbestimmtenArtikel, Negativartikel und Possessivartikel	**6**

Text Books

1. Studio d A1. Deutsch alsFremdsprache with CD.(KursbuchundSprachtraining).

References

1. German for Dummies
2. Schulz Griesbach

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HS 412: FRENCH LANGUAGE - II

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3 hrs
Prerequisite							
HS 303: FRENCH LANGUAGE - I							

COURSE OBJECTIVES:

- To enable the students communicate effectively with any French speaker
- To enable students to access information on the internet, send e mails, pass level 1 exam conducted by Alliance Française de Madras.
- To enable students to enhance their lexical and technical competence and have a competitive edge in the international market.By the end of Phase – II the students will have a reasonable level of conversational skills.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Grammar and Vocabulary:** The second group verbs: Finir, rougir, grossir,grandir. "Les preposition de temps": à, en, le, de 7h à 8h, jusqu' à, vers. Listening and Speaking – the semi- vowels: Voilà, pollutant. Writing - thedays of the week,months, technical subjects, time, "les spécialitésscientifiques et l' annéeuniversitaire, paragraph writing about time table. Reading: Reading of the text and comprehension – answering questions.	6
II	Grammar and Vocabulary – The adjectives, the nationality, feminine &masculinenoun forms "les métiersscientifiques". Listening and Speaking – Vowels: soirée, année, près de, très. Writing: Countries name, nationality, "les métiersscientifiques", numbers from:69 to infitive and some measures of unit.Reading Comprehension: reading a text.	6
III	Grammar and Vocabulary – near future, The demonstrative adjectives, Expressthe aim by using the verb, Listening and Speaking –"La liaison interdite – enhaut". Writing – some scientific terms, French expressions to accept an invitation.Sentence framing. Reading Comprehension – reading a text.	6

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IV	Grammar and Vocabulary –the verbs: manger, boire, the partitive articles Listening and Speaking – "le 'e' caduc Writing- the food, the ingredients, fruits,vegetables, expression of quantity, paragraph writing about food habits. Reading –reading a text.	**6**

Text Books

1. Tech French

References

1. French for Dummies.
2. French made easy: Goyal publishers.
3. Panorama.

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EE-411: ELECTRICAL MACHINES-II LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

LISTOFEXPERIMENTS:
INDUCTIONMOTORS

1. To perform no load test & block rotor test on three-phases quirrel cage induction motor.
2. To perform no load test & block rotor test on three-phase slip ring induction motor.
3. To study the starting methods of three-phase induction motors.
4. To study the cascading of two induction motors.
5. To conduct the load test to determine the performance characteristics of the induction motor.
6. To study speed changing by pole changing method.

SYNCHRONOUSMACHINES

1. To draw characteristics of alternator under different loading condition.
2. To findout regulation by synchronous impedance method.
3. To findout regulation by ZPF method.
4. To draw characteristics of alternator under different loading condition.
5. Top lot V-Curves of asynchronous motor.
6. To measure steady state reactances (X_d,X_q) of asynchronous machine.

NOTE: At least eight experiments are to be performed in the semester from the above list.

Recommended Books:

1. "Experimentation and vivavoce on electrical machines"byV.N.Mittal&A. Mittal, Standard Publications

EE-412: ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3 hrs

LIST OFEXPERIMENTS

1. To identify meters from the given lot.
2. To calibrate an energymeter with the help of a standard wattmeter & a stopwatch.
3. Tomeasure power & powerfactor by3-Ammeter method.
4. Tomeasure power & powerfactor by3-Voltmeter method.
5. Tomeasure power & power factor in 3-phase circuit by2-Wattmeter method.
6. To measure capacitance by DeSauty's bridge.
7. To measure inductance by Maxwell'sbridge.
8. To measure frequency by Wein's bridge.
9. To measure the power with the help of C.T&P.T.
10. To measure low resistance by Kelvin's double bridge.

Note: At least eight experiments to be performed from above list

EE-413:- ELECTRICAL SIMULATION LAB-1

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	3	2	30	20	50	3 hrs

List of Experiments

Software to be used: SimPower Systems (MATLAB Simulink)

1. At least eight computer simulation based electrical models to be studied on SimPower Systems.
2. To verify Kirchhoff's Current and Voltage laws in ac circuit.
3. To verify Superposition and Maximum-Power transfer theorem for a linear electrical system.
4. To study voltage and current relations in a balanced three-phase electrical system for star and delta Load.
5. To simulate no-load and open circuit tests of a two-winding transformer.
6. To simulate speed-torque characteristics of a dc shunt motor
7. To simulate variation of power factor and efficiency of a 3-phase induction motor with load.
8. To simulate ABCD constants of a transmission line.
9. To simulate performance of a long line at various loading conditions.
10. To study the dynamic characteristics of an SCR.
11. To simulate string efficiency of series and parallel connected SCRs.

SEMESTER-V
EE-501: POWER ELECTRONICS-II

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE:

After learning the course the students should be able to analyse, operate and design dc-to-ac inverters, ac-to-ac converters. Also simulate power electronic converters and their control scheme.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Inverter:** Single phase and three phase voltage source inverter, its operating principle, working (steady state analysis derivation not required) Forced-commutated thyristor inverters, Voltage control in single-phase inverters. Pulse-width modulated inverters.	12
II	Single phase current source inverter with ideal switch, capacitor commutated CSI with RL load, series inverter, basic series inverter, half bridge series inverter and modified series inverter, single phase parallel inverter, design specification like turn off time, source current, commutating capacitance(derivation not required).	11
III	**Utility application of power electronics:** Distributed general application, introduction of wind electrical system,photo voltaic system, fuel cell system, micro turbine system, energy storage system, thyristor protection scheme.	8
IV	**Power electronics solution:** Uninterruptable power supplies, dynamic voltage restorer, dual feeder,static switches, static circuit breaker, solid state relay.	8

Text books:

1. ***"Power Electronics: Circuits, Devices& Applications"*** by M.H. Rashid, Prentice Hall of India Ltd,2004.
2. ***"Power Electronics"***by P.S. Bimbhra, Khanna Publishers,2006.
3. ***"Power Electronics"***by M.D. Singhand K.B. Khanchandani, TataMCGrawHillPub,2005.

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EE-502: LINEAR CONTROL SYSTEM

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE:

The objective of this course is to emphasize the importance of control and empower the students with basic concepts on modelling, analysis and design of control systems restricted to linear continuous time system. The specific objectives of each unit are to introduce the classical way of modelling systems, commonly used control components and their mathematical models from physical laws. Also to educate on drawing of specification, choosing of control structures and methods of designing the controllers.

UNIT	CONTENT	NO. OF HOURS
I	**Introduction:** General schematic diagram of control system. Open loop and closed loop control systems, feedback, effects of feedback, linear and non-linear control system. Block diagrams, examples of various control systems. Basic concept of automatic control. **Modelling:** Formulation of differential equations of linear electrical and mechanical system, electrical and mechanical analogies, use of Laplace transform and transfer function, block diagram algebra , signal flow graphs, characteristic equation.	10
II	**Time domain analysis:** Standard test signals, transient response of the first order, second order systems, time domain specifications, dominant closed loop poles of higher order systems, steady state error and error coefficients. **Stability:** Concept of absolute and relative stability, pole - zero location, Routh – Hurwitz criterion.	9
III	**Frequency domain analysis:** Closed loop frequency response,	10

	correlation between time and frequency response, Bode diagram, polar plots, log magnitude vs. phase plot. **Stability in frequency response:**Nyquist stability criterion, stability analysis relative stability.	
IV	**Compensation design:** Necessity of compensation, compensating network, phase margin, gain margin, lag and lead compensation. **Control system components:** Error detectors – potentiometers and synchronous, stepper motor, servo motor.	**10**

Text book:

1. ***"Linear Control System with MATLAB"*** by B.S. Manke,Khannna publishers
2. ***"Control System Engineering"*** by I.J.Nagrath&M.Gopal fifth edition, New Age International Publishers

Reference books:

1. ***"Automatic Control System"*** byDr. F. Golnaraghi,B.C.Kuo ninth edition ,Willey Publication
2. ***"Control System Components"*** by J.F.Gibsen,F B Tuteur , TATA Mc-Graw Hill publishers (MGH)

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EE-503: ELECTRICAL POWER GENERATION

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This course will provide understanding of power generation technology using conventional and nonconventional energy sources which will be useful for understanding the operation and working of power plants.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Conventional Methods Of Generation:** HydroStations-Location, Layout, types and selection of prime mover,Thermal stations-Location, Layout, calculation of energy generated,nuclear stations-Principle of nuclear generation, Location, Layout,calculation of energy generated.	10
II	**Load Curves:** Energy Requirements, Maximum demand,Group Diversity Factor, Peak Diversity Factor, Types of load,Variation in Demand, Load Duration Curve Energy Load Curve,Load Factor, Capacity Factor, utilization Factor, Base Load, PeakLoad and Stand By Stations, Stand By Capacity in Power Plants.	9
III	**Optimal System Operation:** Introduction, optimaloperation of generator on a bus bar. Optimal unit commitment.Reliability consideration, optimum generation scheduling, optimumload flow solution, optimum scheduling of hydrothermal system.	10
IV	**Economic Load Dispatch Of Thermal System:**The economic dispatch problem, thermal system dispatchingneglecting network losses and considering network losses.Economic dispatch by gradient search, base point and participationfactor.	10

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Text book:

1. ***"Generation of electrical energy"*** by Dr.B.R.Gupta
2. ***"A course in electrical power"*** by A.K. Chakrabathi,Soni Gupta Bhatnagar,DhanpatRaiPublishier

Reference book:

1. ***"Elements of electrical power station design"*** by M.V. Deshpande

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EE-504: HIGH VOLTAGE ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

From this course students will understand the basic generation and measurement of high voltage and high current for testing purposes. Also test the high voltage electrical equipment with various testing devices**.**

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Introduction:** Insulation system, types of insulation system. **Discharges in gases:** General characteristics of gaseous insulation, basic processes of ionization in a gas, discharges in uniform and non-uniform fields, Paschen's law, commonly used gases for insulation and their properties. **Breakdown of solids and liquids:** Different mechanisms of breakdown of solids, Intrinsic breakdown, theories of intrinsic breakdown, different theories of breakdown in liquids, commonly used solid and liquid insulating materials and their properties.	9
II	**Lightning phenomenon:** Charge accumulation in clouds – formation and characteristics of lightning stroke, current and voltage magnitudes, protection of transmission lines and substations against lightning, lightning arrestors, switching surges, Insulation co-ordination.	10
III	**Impulse generator:** Definition of impulse wave, single stage and multistage impulse generators and their equivalent circuits, determination of front and tail resistance to produce a given wave shapes.	11

IV	**Measurement of high voltages**: Measurement of direct, alternating and impulse voltages by electrostatic voltmeters, sphere gap, uniform field gap, ammeter in series with high voltage resistors and voltage divider.	**9**

Text book:

1. ***"High Voltage Engineering"*** by M.S.Naidu&V.Kamaraju, Mc-Graw Hill Education.
2. ***"An introduction to high voltage engineering"*** by Subir Ray, PHI Publisher

Reference books:

1. "***High Voltage Engineering"*** – by C.L.Wadhwa , New Age Publication.
2. "***A course in Electrical power"*** by A. Chakrabarti,M.L.Soni, P.V.Gupta, U.S.Bhatnagar, DhanpatRai Publication.

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EE-505: ELECTROMAGNETIC FIELD THEORY

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE: To impart knowledge on the concepts and the computation of Electro-magnetic field which is essential for understanding the working principle, design and analysis of Electrical machines and Systems.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Introduction:** Review of vector analysis, scalar and vector product, gradient, divergence and curl of a vector and their physical interpretation, transformation amongst rectangular, cylindrical and spherical co-ordinate system. **Electrostatic Field:** Coulomb's law, electric field intensity from point charges, Electric field due to continuous field distribution of charges, gauss's law, electric displacement and displacement density, potential functions, potential field of a charge, Laplace's and Poisson's equation, capacitance and electrostatic energy.	**10**
II	**Steady Magnetic Fields:** Faraday Induction law, Ampere's Work law in the differential vector form, Ampere's law for a current element, magnetic field due to volume distribution of current. Ampere's Force Law, vector potential (Alternative derivation), equation of continuity.	**10**
III	**Time Varying Fields:** Equation of continuity for time varying fields, inconsistency of Ampere's law, Maxwell's field equations and their interpretation; solution for free space conditions, electromagnetic waves in a homogeneous medium, propagation of uniform plane wave, relation between E & H in a uniform plane-	**10**

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	wave, wave equations for conducting medium, Maxwell's equations using phasor notation, wave propagation in a conducting medium, conductors, dielectrics, wave propagation in good conductor and good dielectric.	
IV	**Reflection And Refraction of EM Waves:** Reflection and refraction of plane at the surface of a perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence), Brewster's angle and total internal reflection, reflection at the surfaces of a conductive medium, surface impedance, transmission-Line analogy, pointing theorem. **Transmission Line Theory:** Transmission line as a distributed circuit, transmission line equation, travelling & standing waves, characteristic impedance, input impedance of terminated line, reflection coefficient, Smith's chart and its applications.	**9**

Text book:

1. ***"Electromagnetic field theory and transmission lines"***: G.S.N. Raju.
2. ***"Electromagnetic field theory***" PV Gupta.

Recommended books:

1. ***"Electro-magnetic Waves and Radiating System"***: Jordan &Balmain, PHI.
2. ***"Engineering Electromagnetic"***: Hayt; TMH.

3.."***Electro-Magnetics".*** Krauss J.DF; McGraw Hill.

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EE-506: FLEXIBLE AC TRANSMISSION SYSTEM

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE:

To understand the concept of flexible ac transmission and the associated problems.Also to review the static devices for series and shunt control and the operation of controllers for enhancing the transmission capability**.**

UNIT	CONTENT	NO. OF HOURS
I	**Introduction:** The concept of flexible AC transmission, reactive power control in electrical power transmission lines, uncompensated transmission line, series and shunt compensation, Overview of FACTS devices - Static Var Compensator (SVC),Thyristor Switched Series capacitor (TCSC),Unified Power Flow controller (UPFC),Integrated Power, Flow Controller (IPFC).	**10**
II	**Static var compensator (svc) and applications:** Voltage control by SVC, influence of SVC on system voltage. Applications, steady state power transfer, enhancement of power system damping, prevention of voltage instability.	**10**
III	**Thyristor controlled series capacitor (tcsc) and applications:** Operation of the TCSC, Different modes of operation, Applications, Improvement of the system stability limit, enhancement of system damping, voltage collapse prevention. **Emerging facts controllers-**Static Synchronous Compensator (STATCOM), operating principle,V-I characteristics, Unified Power Flow Controller (UPFC), Principle of operation - modes of operation, applications.	**10**
IV	**Co-ordination of facts controllers:** FACTs Controller interactions,	**9**

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	SVC–SVC interaction, co-ordination of multiple controllers using linear control techniques, Quantitative treatment of control co-ordination.	

Text book:

1. Mohan Mathur, R., Rajiv. K. Varma, *"**Thyristor: Based Facts Controllers for ElectricalTransmission Systems",*** IEEE press and John Wiley & Sons, Inc.
2. ***"Flexible ac Transmission System: Modelling and Control"*** by Xiao Ping zhang, ChristianRehtanz, Bikash Pal.

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OPEN ELECTIVE-III

EE-507: NON CONVENTIONAL ELECTRICAL POWER GENERATION

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3hrs

COURSE OBJECTIVE:

It introduces solar energy, its radiation, collection, storage and application. It also introduces the wind energy, bio-mass energy, geothermal energy and ocean energy as energy sources.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Introduction To Energy Sources:** energy consumption as a measure of prosperity, future of world energy, energy sources and their availability (commercial and non-commercial energy sources).	7
II	**Wind Energy:** Introduction, Origin of wind, Basic principles of wind energy, site selection consideration, and Basic components of wind energy conversion system, Classification of WEC system, Advantages and Disadvantages of WEC system. **Solar Energy**: Introduction, solar constant, solar radiation, solar energy collector, applications of solar energy.	7
III	**Energy From Biomass:** Introduction, biomass definition, Biomass conversion technologies, Photosynthesis, factors effecting the Bio-digestion or generation of gas.	5
IV	**Geo-Thermal Energy:** Introduction, Geothermal sources development of geothermal power in India. Advantages and disadvantages of geothermal energy over other energy form.	7

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Text book:
1. ***Non-Conventional Energy Resources*** by G.D Rai.

Reference books:
1. ***An Introduction To Power Plant Technology*** by G.D.Rai.
2. ***Renewable Energy Sources*** by MaheshwarDyal.

OPEN ELECTIVE-III
EE-508: ENERGY ASSESSMENT AND AUDIT

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3hrs

COURSE OBJECTIVE: This subject will give the student overall idea about energyscenario, supply and demand side verification, methodology for their improvement in current scenarios and energy auditing practice.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Introduction:** Review of different Energy Sources, Need and objectives of Energy Conservation, Significance of Energy Assessment, Supply and Demand Side Management.	6
II	**Energy Audit:** Need for Energy Audi**t,** Types of Energy Audits, National Energy Plan and its impact on Energy Conservation, Energy audit team, Energy Audit Reporting format, Energy Audit Instruments.	7
III	**Energy Efficient Technologies:** Life cycle assessment, Energy efficient Motors, BIS Specifications for Energy Efficient Motors, Energy Efficient lighting sources.	6
IV	**Energy Audits Practice:** Energy Audits of building systems, electrical systems, maintenance and Energy Audits.	5

Text Book:

1. ***Handbook of Energy Audits*** by Albert Thuman – Fairman Press Inc.
2. ***Energy basis for man and nature*** by Howard T.Odum&ElisbethC.Odum.
3. ***Energy Management*** by UmeshRathore, Kataria Publications

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OPEN ELECTIVE-III

EE-509: ROBOTICS

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	0	0	2	40	60	100	3hrs

COURSE OBJECTIVE:

After learning this course, the students should be able to:

4. Learn the mathematics of rigid motions, rotations, translations, velocity kinematics.
5. Evaluate the various parts of mechanical and electronic system of robots.
6. familiar with computer vision, visual servo control problems and applications in the industry.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Basic Concepts:** Definition and origin of robotics, different types of robotics, various generations of robots, degrees of freedom, Asimov‘s laws of robotics, dynamic stabilization of robots.	5
II	**Power Sources:** Hydraulic, pneumatic and electric drives, determination of HP of motor and gearing ratio, variable speed arrangements, path determination, micro machines in robotics.	**7**
III	**Manipulators, Actuators And Grippers Construction Of Manipulators:** manipulator dynamics and force control, electronic and pneumatic manipulator control circuits, end effectors, various types of grippers, design considerations.	**7**
IV	**Sensors And Intelligent Robots:** Introduction to robotic sensors, vision systems, Range detectors, assembly aid devices, force and torque sensors, machine vision, ranging, laser, acoustic, magnetic fiber optic and tactile sensors.	**7**

Text books:

1. ***Robot Modeling and Control*** by Spong, M.W., Hutchinson, H., &Vidyasagar, M., John Wiley (Wiley India Ed.), 2006, ISBN-13: 978-0471649908.

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2. ***Robotics Engineering – An integrated approach*** by R.D. Klafter, T.A. Chimielewski, Negin M., Prentice Hall of India, 1994, ISBN-13: 978-0134687520.
3. ***Introduction to Robotics*** by SAHA, Tata McGraw-Hill Education, 2008, ISBN 9781259083204.
4. ***Control in Robotics and Automation Sensor Based Integration (Engineering)*** by B. Ghosh, T. J. Tarn, Ning Xi, Academic Press, ISBN: 978-0122818455.

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EE-511: POWER ELECTRONICS-II LAB

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 7-8 experiments must be performed by a student during the semester.

LIST OF THE EXPERIMENTS TO BE PERFORMED:

1. To study triggering circuits for thyristor: Resistor triggering circuit; R-C triggering circuit.
2. To Study of 1- pulse and 2- pulse converter with R and R L load.
3. To Study of three phase full converter with R and R-L load.
4. To study SCR Half Wave and Full Wave Bridge Controlled Rectifier Output characteristics.
5. To study three Phase Full-Wave Uncontrolled Rectifier Operation with R and R-L Load and observe its input/output Characteristics.
6. To study Single Phase Cycloconverter output characteristics.
7. Series operation of SCR's.
8. Parallel operation of SCR's.
9. Lamp-Dimmer Using diac&triac with Lamp Load.
10. Speed Control of DC motor using SCR's

EE-512: LINEAR CONTROL SYSTEM LAB

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 6-7 experiments must be performed by a student during the semester.

LIST OF THE EXPERIMENTS TO BE PERFORMED:

1. To plot speed torque characteristics of a 2 phase AC servomotor.
2. To plot speed torque characteristics of a 2 phase DC servomotor.
3. To study the close loop control of a three phase AC motor
4. To study the step response of a second order system for different damping factors.
5. To study the magnetic amplifier.
6. To study the microcontroller based stepper motor controller circuit.
7. To study various lag-lead compensation network.
8. To study the synchro transmitter rotor position versus stator voltage for three phase.

EE-513: ELECTRICAL SIMULATION LAB-II

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 6-7 experiments must be performed by a student during the semester.

List of the experiments to be performed:

1. Study of matlab code for calculation of efficiency and voltage regulation of transformer.
2. Study of matlab code for calculation of efficiency and voltage regulation of dc motor.
3. Study of matlab code for calculation of efficiency and voltage regulation of poly phase induction motor.
4. Study of matlab code for calculation of efficiency voltage regulation of single phase induction motor.
5. Study of matlab code for calculation of efficiency voltage regulation of synchronous generator.
6. Plot 1storder and 2nd order open loop and closed loop system by matlab Simulink.
7. Find time domain analysis of 1st and 2nd order system and represent their parameters on graph itself.
8. Matrix operations like multiplication, inverse, transpose, conjugate, determinant, Eigen values.
9. Matrix to system gain and vice versa conversion by programming.
    A. Stability checking methods: Root locus technique method
    B. Polar plot
    C. Bode Plot
    D. Nyquist criteria
10. Compensation by lag, lead, compensator by both Simulink and programming method.
11. Cascade speed control of dc motor drive.

SEMESTER-VI
EE-601: SWITCHGEAR AND PROTECTION

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This subject gives descriptive and analytical idea about relays and different types of protection schemes of power system network.

COURSE CONTENT:

UNIT	CONTENT	NO.OF HRS
I	**Protective relays:** Introduction, Operating Principle of relay, Classification of relay, electromagnetic attraction relays. Electromagnetic induction relays, over current relays, Induction type directional power relay, Induction type directional over current relay, Universal relay torque equation, distance protection, Differential relay.	9
II	**Feeder protection:** Introduction, Over current protection and earth fault protection, time graded protection, current graded protection, differential Pilot wire protection, merz price voltage balance system, pilot protection, Bus Bar protection. **Transformer Protection:** Introduction, types of faults on transformer, bucholtz protection, Differential protection for power transformer, biased differential protection, Restricted earth fault protection, motor protection.	10
III	**Generator protection:** Introduction, generator faults, stator protection, rotor protection, motor protection. **Static Relays:** Basic concepts, Input Output devices, amplitude and Phase comparator,Over current relays, directional static over current relay, static differential relay.	10
IV	**Theory of arc interruption:** Arc Phenomenon, arc interruption**,** arc interruption theories. **Circuit Breakers:** Air break circuit breaker, oil circuit breaker, Air blast circuit breaker, Vacuum circuit breaker, SF6 circuit breaker Testing and	10

	maintenance of circuit breakers. **Fuses**: Types, characteristics and construction of HRC fuses.	

Text book:

1. A course in Electrical Power by J.B Gupta: S K Kataria& Sons Publishing Company
2. A course in Electrical Power by A. Chakrabarti,M.L.Soni, P.V.Gupta,U.S.Bhatnagar, DhanpatRai Publishing Company (P) Limted.

Reference book:

1. Principle of power system by V.K Mehta
2. Power System Protection and Switchgear by B. RavinderNath&M.Chander, Wiley Eastern

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EE-602: MICROPROCESSORS & APPLICATIONS

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

- To study the Architecture of 8085, 8086 & 8051.
- To introduce commonly used peripheral/ interfacing ICs.
- To study the addressing modes & instruction set of 8085 & 8051 and to develop skills in simple program writing.
- To study and understand typical applications of micro-processors and micro-controllers.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HRS
I	**Introduction:** Introduction, Evolution of microprocessor, 8085 microprocessor architecture and its functional blocks, 8085 pin diagram, address, data and control buses,8085features. **Addressing Modes:** Direct addressing, indirect addressing, indexed, register direct, register Indirect, implicit addressing mode, Timing diagrams, typical instruction set of 8085 microprocessor.	**10**
II	**Programming:** Development of Assembly language program. Interrupts: hardware &software & data transfer: Interrupt system of 8085 Types of memory and memory interfacing Decoding techniques – absolute and partial.	**8**
III	**Mapping Techniques:** I / O mapped I /O and memory mapped I / O, Serial I/O lines of 8085 and the implementation asynchronous serial data communication using SOD and SID. **Peripheral Devices & Applications Of Microprocessor:** Description of 8251, 8255, 8253, 8257, 8259, 8279.Cycle stealing and burst mode of DMA controller. Synchronous and asynchronous data transfer 8251.	**8**

IV	**8086 Microprocessor:** Main features, Architecture-the execution unit and bus interface unit, Memory segmentation, Memory addressing, 8086 hardware pin signals, 8086 minimum and maximum modes of operation.	**5**

Text book:

1. ***Microprocessor & Architecture, programming and application*** by Gaonkar.
2. ***"Microprocessors and Digital Systems"***, D.V.HALL, McGraw Hill
3. ***"Microprocessor and Microcontrollers"***, Senthil, Saravanam (Oxford University Press)

Reference books:

1 "***An introduction to microprocessor",***A.P.Mathur.
2 "***The 8086 Microprocessor –Kenneth",*** J Ayala
3. "***Fundamentals of microprocessor & microcomputers",*** – B.Ram

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EE-603: POWER SYSTEM ANALYSIS

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE:

This subject is useful to get an comprehensive idea about economic aspect of power generation, its reliability, frequency and voltage stability and design of controller.

COURSE CONTENT:

Unit	Content	No. Of hours
I	**Power System Components:** Introduction, single phase solution of balanced three phase networks, single line diagram, per unit system, complex power, synchronous machine, representation of loads.	10
II	**Load Flow Studies:** Network model formulation, Formation of Y-Bus by singular transformation, load flow problem, gauss-siedel method, Newton-Raphson method, decoupled load flow method**.**	10
III	**Fault Analysis:** symmetrical component phase shift in star delta transformer, sequence impedance of transmission lines, sequence impedance of power system, symmetrical component analysis of unsymmetrical component. L-G fault, L-L fault, L-L-G fault, L-L-L fault.	10
IV	**Stability:** Dynamics of synchronous machine, power angle equation, nodal elimination technique, steady state stability, transient stability, equal area criteria, numerical solution of swing equation, factors affecting transient stability.	10

Text Books:

1. ***Power System Engineering*** by D. P. Kothari and I. J. Nagrath , TMH publication.
2. ***Power system Analysis*** J.J. Grainger, W.D. Stevenson jr, Mc-Graw Hill Education Publisher Company.
3. ***Electrical Power System*** by B.M. Weedy, B.J.Coryu, N.Jenkins , John Willey & sons Publisher Company.
4. ***Electrical Power System*** by C.L.Wadhwa.
5. ***Power System Analysis Design*** by B. R. Gupta S. Chand and Company.

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EE-604: ELECTRICAL DRIVES

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE:

This subject is all about steady state transient state dynamics of motor load system and also study of different types of motor drive application.

COURSE CONTENT:

UNIT	CONTENTS	NO. OF HRS
I	**Introduction To An Electric Drive System:** Dynamic equations of an electric drive, torque equations, multi-quadrant operation, type of loads, energy loss during transients and load equalization.	10
II	**Control Of Electric Drives:** Speed control, closed loop position and speed control. Selection of motor rating thermal model of motor, classes of duty and determination of motor rating for different classes duty.	10
III	**Dc Motor Drives:** Starting, braking, speed control, controlled rectifier converters for DC drives and chopper fed DC drives.	10
IV	**Induction Motor Drives:** Starting, braking, speed control, ac controller fed induction motor, voltage source inverter. Current source inverter and cylco-converter fed induction motor drive.	10

TEXT BOOK:

1. ***"Electrical Drives",*** G.K. Dubey, Narosa Publishing House.

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EE-605: DIGITAL SIGNAL PROCESSING

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	1	0	4	40	60	100	3hrs

COURSE OBJECTIVE:

After study of this subject student should be comfortable with design of filter and their design consideration by different techniques.

COURSE CONTENTS:

UNITS	CONTENTS	NO. OF HRS
I	**Continuous and Discrete Time Signal Analysis:** Basic elements of a digital signal processing system advances of digital over analog signal processing Signal analysis, signal characteristics, some elementary analog and discrete time signals, simple manipulations of discrete time system signals, properties of linear time, invariant digital systems and interconnection of LTI systems, sampling of analog signals and sampling rate conversion. Z-transform. Properties of Z-transform, inverse Z-transform, analysis of continuous and discrete time systems, properties of convolution, correlation of discrete time signals.	14
II	**Frequency domain analysis of continuous and discrete Time signals:** Fourier series for periodic signals, Fourier transform, discrete Fourier series, Discrete Fourier transform (DFT) and inverse Discrete time Fourier Transform properties, circular convolution, Fast Fourier Transform (FFT), Decimation-in-Time (DIT) algorithm, decimation in-frequency algorithm FFT, Radix-2 DIT and DIF implementation, applications of FFT algorithms.	10
III	**Filter Structures:** FIR filter structures and IIR filter structures, frequency sampling structure for FIR filter, direct form I and II, cascade structure, parallel structure, lattice structure.	6

IV	**Digital Filters:** FIR Filters, design of linear phase filters, linear phase properties, design using window method, frequency sampling design, IIR filters, Pole-zero representation, Chebyshev and Butterworth filter,IIR filter design using approximation of derivative method,Impulse invariance method, Bilinear transform method, Matched z-transform method, Frequency transformations.	**10**

Text books:

1. John G. Proakis, Dimitris G. Manolakis, ***"Digital Signal Processing: Principles, Algorithms and Applications,"***Prentice Hall of India Pvt. Ltd., 2008.
2."***Digital Signal Processing",*** S.SalivahananAVallavaraj C Gnanapriya.
3.***Digital Signal Processing",***Shaila D. Apte- 2nd Edition Wiley India edition.

Recommended books:

1. Emmanual C. ifeachor, ***"Digital Signal Processing a practical approach".***Prentice Hall India.
2. Boaz Porat, "***A Course in Digital Signal Processing,"*** Prentice Hall Inc, 1998.
3. Oppenheim A. V., Schafer R. W., "***Discrete-Time Signal Processing,"*** Prentice Hall India, 1996.
4. Chi-Tsong Chen, "***Digital Signal Processing: Spectral Computation and Filter Design***," Oxford University Press, 2001

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EE-606: ELECTRICAL ENERGY UTILIZATION

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

- To analyze the various types of traction system and their application.
- To introduce the energy saving concept by different ways of illumination.
- To understand the refrigerator and air conditioning system and its electrical energy conversion process.

COURSE CONTENTS:

UNITS	CONTENTS	NO. OF HRS
I	**Electric Traction:** Introduction, requirement, different systems traction, comparison of dc and ac systems of railways electrification, power supply, ac locomotive.	9
II	**Electric Heating:** Methods of electric heating**,** Constructional details and performance of resistance heating furnaces, direct and indirect induction and arc furnaces, estimation of power and energy requirement, power supply problems.	10
III	**Electrical Welding:** welding and its classification, resistance arc and atomic hydrogen welding, inert gas metal arc welding , carbon arc welding , electric supply for arc welding , ultrasonic welding, laser welding , different types of control equipment used for controlling temperature and pressure in arc and resistance welding , welding transformer.	10
IV	**Refrigeration And Air Conditioning:** Applications of refrigeration, Systems of refrigeration, vapor compression cycle, absorption and thermos electric refrigeration, unit of refrigeration, types of refrigerant, domestic refrigerator, water cooler, air conditioning.	10

Text Books

1. ***"Art and Science of Utilization of Electrical Energy"*** by H.Partab.
2. ***"Utilization of Electrical Energy"*** by Openshaw Taylor.

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Reference Book

1. "***Utilization of Electrical Energy"*** by R.K Rajput.

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PROGRAMME ELECTIVE-I
EE-607: ADVANCED CONTROL SYSTEM

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

- To gain knowledge in design of state variable systems, analysis of non-linear systems and introduction of optimal control.
- To study the state variable design.
- To provide adequate knowledge in the phase plane analysis.
- To study describing function analysis.
- To analyze the stability of the systems using different techniques.
- To introduce the concepts on design of optimal controller.

COURSE CONTENT:

UNITS	CONTENTS	NO. OF HRS
I	**State Variable Analysis:** Introduction, concept of state, state variable and state model, state space representation of systems, block diagram for state equation, Transfer function decomposition, direct, parallel and cascade decomposition, solution of state equations, concept of controllability and observability.	10
II	**Sampled Data Control Systems:** Introduction, digital control systems, quantization concept, data acquisition, conversion and distribution system, z-transform, important properties, inverse z transform, difference equation and solution using z-transform.	9
III	**Analysis of Discrete Time Systems:** Impulse sampling and data hold, reconstruction of original signals from the sampled version, pulse transfer function for open loop and closed loop systems, mapping between z-plane and s-plane, stability analysis using Jury's test, bilinear transformation, state space representation of discrete time systems and solution of discrete time state equations.	10

IV	**Non Linear Systems:** Introduction, different non-linearity's, phase plane method, singular points, stability of nonlinear systems, phase plane method, concepts of describing function method, stability analysis using describing function method, jump resonance phenomena, Liapunov and Popov stability criterion.	**10**

Text books:

1. "***Linear control system"*** by Prof. B.S. Manke
2. "***Control System Engineering"*** by Nagrath and Gopal, "New Age International".

Recommended books:

1. "***Discrete time Control Systems"*** by K. Ogata, "Prentice Hall International".

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PROGRAMME ELECTIVE-I
EE-608: ILLUMINATION ENGINEERING

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This subject is about illumination principle, classification and designof different types of lightening system applications.

COURSE CONTENTS:

UNITS	CONTENTS	NO. OF HRS
I	**Introduction:** Laws of illumination - Inverse Square law and Lambert's Cosine law, their application in lighting calculations by point-by-point method. **General principles of illumination**: Definitions, units of light, definitions of flux, solid angles, luminous intensity and brightness, glare, polar curves.	9
II	**Electric light sources:** Brief description of characteristics of starting and application of incandescent lamp, sodium vapour lamp, mercury vapour lamp, fluorescent lamp, neon lamp, compact fluorescent lamp, led lamp. **General illumination design (lumen method):** Selection of equipment, equipment efficiency, room index and utilization factor, maintenance factor, computation for lamp size, core lighting design, optical design methods, Louver design.	10
III	Elementary idea of the special features required and minimum level of illumination required for (i) Domestic. (ii) Commercial (iii) Educational. (iv) Health (v) Industrial buildings. Architectural lighting concepts in above buildings.	10
IV	Design of lighting system for a stadium, theatre hall, indoor play hall, External and internal lighting of historical building, hospital lighting, air-port lighting, tunnel lighting, underwater lighting.	10

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Text books:

1. "***Electric Illumination"*** by John O.Kraehenbueshl, John Wiley & Sons.
2. "***Lamps and lighting"*** by H.Howitt&A.S.Vause.
3. "***Load lighting"*** by Ir. W.J.M. Van Bommel

EE 609: NEURAL NETWORKS AND FUZZY LOGIC

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This course introduces the basics of neural network and its types and also about fuzzy set and fuzzy logic system component and its effectiveness in real world application.

COURSE CONTENT:

UNIT	CONTENT	NO. OF Hrs.
I	**ANN Model And Architecture:**Biological foundations, ANN models, types of activation function, introduction to network architecture, multilayer feed forward network (MLFFN), radial basis function network (RBFN), recurring neural network.	**10**
II	**Learning Processes:** Supervised and unsupervised learning, error-correction learning, Hebbian learning, Boltzmann learning, single layer and multilayer perception model, least mean square algorithm, back propagation algorithm, Application in forecasting and pattern recognition and other power engineering problems.	**10**
III	**Fuzzy Setss And Theory:** Fuzzy sets, fuzzy set operations, properties, membership functions, fuzzy to crisp conversion, measures of fuzziness, fuzzification and defuzzification methods.	**8**
IV	**Hybrid Intlligent System:** Genetic algorithm, neuro fuzzy system, adaptive neuro-fuzzy inference system, evolution of neural network, fuzzy evolutionary system.	**9**

Text Books :

1. M. T. Hagon, Howard B. Demuth and Mark Beale, ***" Neural Network Design, PWS Publishing Company"*** 1995.
2. Jacek M Zurada, "***Introduction to Artificial Neural Systems***", Jaico Publishing House, Bombay, 1994

3. Wasserman, "***Neural Computing: Theory and Practice,*** Van Nastrand Reinhold, 1989".
4. Freeman, J. A. and D. M. "***Neural Networks _-Algorithms, application and programming techniques,*** Addison Weley, 1991".

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EE-611: SWITCHGEAR & PROTECTION LAB

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 6-7 experiments must be performed by a student during the semester.

LIST OF EXPERIMENTS:

1. To plot time-current characteristics of an IDMT relay.
2. To plot time current characteristics of Electromagnetic type over-current relay.
3. Study of the performance and operation of a three phase over-current andearth fault static relay.
4. Symmetrical fault level analysis on a d.c.network analyzer.
5. Unsymmetrical fault level analysis on a d.c. network for various type of faults.
6. To study transformer differential protection.
7. To study the magnetization characteristics of C.T
8. To study the problems associated with C.T. magnetization.
9. Performance and study of Merz-Price protection.

Note: At least six experiments to be done from above list.

EE-612: MICROPROCESSORS & APPLICATIONS LAB

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 6-7 experiments must be performed by a student during the semester.

LIST OF EXPERIMENTS:

8085 Based

7. Addition and subtraction of two 8-bit numbers with programs based on different addressing modes of 8085A.

8. Addition and subtraction of two 16-bit numbers. (Using 2's complement method, also programs which access numbers from specified memory locations.).
9. Multiplication of two 8-bit numbers using the method of successive addition and Shift & add.
10. Division of two 8-bit numbers using the method of successive subtraction and shift & subtract.
11. Block transfer and block exchange of data bytes.
12. Finding the smallest and largest element in a block of data.
13. Generation of Fibonacci Series.

Application Based (Max 2)

6. Program controlled data transfer using 8255 PPI.
7. To INPUT data bytes from peripheral port and to store them in memory.
8. To OUTPUT data bytes from memory to peripheral port.
9. To Study of interrupts by enabling them in main line program and then executing different subroutines when TRAP, RST 7.5, RST 6.5 & RST 5.5 are activated.

EE 613: SEMINAR

Evaluation Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Evaluation
L	T	P/D	C	Sessional	End Semester Evaluation/ Viva	Total	
0	0	2	1	50	50	100	-

OBJECTIVE:

To measure as well as flourish the ability of the student to study a topic, in Electrical Engineering, of current relevance, from technical literature and present a seminar on that topic.

PROCEDURE:

Individual students should be asked to choose a topic in any field of Electrical Engineering, preferably from outside the B.Tech syllabus and give a seminar on that topic for about thirty minutes. It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report (in two copies), based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members (preferably specialized in various sub-fields of Electrical Engineering) will evaluate the seminar. One of the two copies submitted by the student should be returned to him/her after duly certifying it by the staff in charge of the seminar and Head of the department and the other copy shall be kept in the departmental library.

Internal Continuous Assessment
As per ordinance

SEMESTER-VII
EE-701: ENERGY MANAGEMENT

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This subject will give the student overall idea about energy scenario, security reliability,optimization method cost effective methods.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs
I	**Energy Scenario:** Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment, Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future.	8
II	**Energy Management:** Definition, Energy audit- need, types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies,optimizing the input energy requirements, Fuel and energy substitution.	10
III	**Financial Management :**Investment-need, Appraisal and criteria, Financial analysis techniques, Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.	9
IV	**Electrical System:** Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement.	9

Text books:

1) ***"Handbook on Energy Audit and Environment Management"*** by Abbi, Y.P. and Jain, S.Teri Press, 2006.
2) ***"Energy Conservation"*** by P.Diwan and P. Dwivedi, Pentagon Press, 2008.
3) ***"Handbook of Energy Audits",*** by A.Thumann, W.J.Younger, T.Niehus, CRC Press,8th Edition, 2008.

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EE-702: ELECTRICAL POWER QUALITY

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This subject solely belongs to maintain power quality degradation causes and their reduction to a certain permissible limit such that it will benefit the manufacturer and customer of power usage. Hence students learn about basic fundamental techniques of maintaining such quality of power and crate awareness in the society.

COURSE CONTENT:

UNIT	CONTENT	No. of hrs
I	**Power Frequency Disturbance:**Introduction, common power frequency disturbances, cures for low frequency disturbances, voltage tolerance criteria.	**10**
II	**Power Factor:**Active Power and reactive power, displacement and true power factor, power factor improvement, power factor correction, power factor penalty, other advantages of power factor correction, voltage rise due to capacitance, application, svc.	**10**
III	**Measuring And Solving Power Quality Problems:**measuring devices and procedure for power quality, number of test locations and duration, instrument set up and guidelines.	**9**
IV	**Grounding And Bonding:**Shock and fire hazards, essentials of a grounded system, ground electrode, earth resistance test, earth ground grid system, power ground system, signal reference ground and methods, single point and point grounding, ground loops.	**10**

Text books:

1. ***"Power Quality"*** by C. Shankaran
2. ***"Power Quality in Electrical System"*** by Alexander Kusko McGraw-Hill Companies.
3. ***"Electrical Power System Quality"*** by Roger C. Dugan, Mark F. Mcgranaghan,SuryaSantosoH.WayneBeaty Tata McGraw-Hill Publishing company limited

EE-703: NON CONVENTIONAL ELECTRICAL POWER GENERATION

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

It introduces solar energy, its radiation, collection, storage and application. It also introduces the wind energy, bio-mass energy, geothermal energy and ocean energy as energy sources.

COURSE CONTENT:

UNIT	CONTENT	NO.OF HRS
I	**Introduction**: energy sources, energy consumption as a measure of prosperity, future of world energy, energy sources and their availability (commercial and non-commercial energy sources).	8
II	**Wind Energy:** Introduction, Origin of wind, Basic principles of wind energy, site selection consideration, and Basic components of wind energy conversion system, Classification of WEC system, Advantages and Disadvantages of WEC system. **Solar Energy:** Introduction, solar constant, solar radiation, solar energy collector, applications of solar energy.	10
III	**Energy From Biomass:** Introduction, biomass definition, Biomass conversion technologies, Photosynthesis, factors effecting the Bio digestion or generation of gas. **Geo-Thermal Energy:** Introduction, Geothermal sources development of geothermal power in India. Advantages and disadvantages of geothermal energy over other energy form.	10
IV	**Energy From The Oceans, Tidal, Wave**: Introduction, Basic principle of tidal power, Wave energy, Ocean Thermal Energy Conversions System. **Small And Mini Hydro Power**: Introduction, site selection, classification of small hydro power stations, advantages and limitations of small scale hydroelectric power system	10

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Text book:

1. ***"Non-Conventional Energy Resources"*** by G.D Rai

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Reference books:

1. ***"An Introduction To Power Plant Technology",*** By G.D.Rai.
2. ***"Renewable Energy Sources",***MaheshwarDyal.

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EE-704: ELECTRICAL MACHINE DESIGN

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
2	2	0	3	40	60	100	3hrs

COURSE OBJECTIVES:

After studying this subject students should be able to understand the intention of special design features of different machine such that they are able to design them.

COURSE CONTENT:

Unit	Content	No. of Hrs
I	Classification of insulating material, classification of magnetic material, super conductivity, methods of cooling of transformer, types of enclosure, hydrogen cooling, direct water cooling. Types of ventilation. Temperature rise, calculation, heating curve, cooling curve,methods used for selection of motor rating for variable drives power rating.	10
II	Output equation, Choice of Specific magnetic loading, choice of specific electric loading, output equation, variation of output and losses with linear dimension. Specific slot presence for parallel sided slot, leakage reactance calculation of poly phase machines, leakage reactance of cylindrical coils and sandwiching coils of equal width.	9
III	**Transformer:** Single phase and three phase, core and shell, power and distribution of transformer, core construction of modern core type transformer, transformer winding, output equation, ratio of iron loss to copper loss, relation between core area, weight of iron and copper. Simplified steps for transformer design, no-load current, magnetising volt-ampere, regulation, efficiency.	9
IV	**Induction Motor:** Area of stator slot, length of air gap, rotor design of squirrel cage and wound rotor induction motor, area, shape and size of rotor bar, design of end ring, area of end ring, methods of improving	10

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	starting torque,losses,efficiency.	

Text books:

1. ***"A Course in Electrical Machine Design"*** by A K SawhneyDhanpatRai Publication.
2. ***"Principle of Electrical Machine Design"*** by Dr. H M Rai.

Recommended book:

1. ***"Electrical Machine Design"*** by L.K. Khera

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EE-705: HYDRO POWER STATION DESIGN

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This course will empower the students to with the basic requirement, fundamental, principles, classification according to the specifications and to design a hydro power station.

COURSE CONTENT:

UNIT	CONTENT	NO.OF HRS
I	Introduction, hydrology, stream flow, Hydrographs, flow duration curve, mass curve, storage, investigation of site.	8
II	Types of dams, arrangement and location of hydro- electric station, types of hydroelectric plant and their field of use, principle of working of hydroelectric plant.	9
III	Developed power, size of plant and choice of units, types of turbine and their characteristics, design of main dimensions of turbine.	9
IV	Draft tubes, turbine setting and penstock dimensions, scroll case, preliminary design of penstock, characteristics of generators.	9

Text book:

1. "***Power station design"*** by M.V. Deshpande PHI Publication.

PROGRAMME ELECTIVE-II

EE-706: TESTING & COMMISSIONING OF ELECTRICAL EQUIPMENTS

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This course will enable the students to understand the concepts, principles and acquired basic skills of installation, commissioning and maintenance of electrical equipments in power stations, substations, and industry.

COURSE CONTENT:

UNIT	CONTENT	NO.OF HRS
I	**Earthing:** Introduction to earthing, Station earthing, neutral grounding and equipment grounding, step potential, touch potential, pipe earthing and plate earthing, material used in earthing, General requirement of earthing as per Indian Electricity Rules for buildings and industrial premises.	9
II	**TestingAnd Commissioning Of Transformers:**Type, routine and commissioning tests on power and distribution transformers, Filtering and drying out of transformer oil, information required for ordering a transformer, recommended maintenance schedule of transformers, testing, commissioning of C.T/P.T	10
III	**Testing And Commissioning Of Rotating Machines:**Type, routine and commissioning tests, Selection, location and mounting of machines, Frame sizes, Degree of protection, standard IP and IC code, type of enclosures, Foundation and civil work, Checks before commissioning of machines of d.c., induction and synchronous machines, Recommended maintenance schedule of rotating machines (d.c., induction and synchronous), covering: - Mechanical and electrical maintenance. - Preventive maintenance, overhauling and safety precautions. - Permissible temperature rise limits. - Idea of MTBF and MTTR.	10

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IV	**Commissioning And Maintenance Of L.T. Panels:** Type and rating of bus-bars, A.C.B.s, MCCBs, ELCBs and MCBs etc, Location and rating of power factor improvement apparatus. **Safety Precautions:** Safety precautions for testing, commissioning and maintenance of electrical equipments (low and medium voltage apparatus).	**9**

Text book:

1. "***Testing, Commissioning, Operation and Maintenance of Electrical Equipment"*** by S.Rao, Khanna Publishers.

Reference book:

1. "***Handbook of Electrical Engineering"*** by S.L.Bhatia, Khanna Publishers.

PROGRAMME ELECTIVE-II
EE-707: HIGH VOLTAGE DC TRANSMISSION SYSTEM

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

OBJECTIVES:

- To understand the concept, planning of DC power transmission and comparison with AC
- Power transmission.
- To analyse HVDC converters.
- To study about the HVDC system control.
- To analyse harmonics and design of filters.
- To model and analysis the DC system under study state.

COURSE CONTENT:

UNIT	CONTENT	NO.OF HRS
I	**Introduction:**Insulation system, types of insulation system. **Discharges In Gases:** General characteristics of gaseous insulation, basic processes of ionization in a gas, discharges in uniform and non-uniform fields, Paschen's law, commonly used gases for insulation and their properties. **Breakdown Of Solids And Liquids**: Different mechanisms of breakdown of solids, Intrinsic breakdown, theories of intrinsic breakdown, different theories of breakdown in liquids, commonly used solid and liquid insulating materials and their properties.	**10**
II	**Lightning Phenomenon:** Charge accumulation in clouds – formation and characteristics of lightning stroke, current and voltage magnitudes, protection of transmission lines and substations against lightning, lightning arrestors, switching surges, Insulation co-ordination	**9**
III	**Impulse Generator:** Definition of impulse wave, single stage and multistage impulse generators and their equivalent circuits, determination of front and tail resistance to produce a given wave shapes.	**10**
IV	**Measurement Of High Voltages**: Measurement of direct, alternating and impulse voltages by electrostatic voltmeters, sphere gap, uniform field gap, ammeter in series with high voltage resistors and voltage divider.	**9**

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Text book:

1. ***"An introduction to high voltage engineering"*** by Subir Ray.
2. ***"High Voltage Engineering"*** by M.S.Naidu&V.Kamaraju

Recommended books:

1. "***High Voltage Engineering"*** by C.L.Wadhwa
2. "***A course in Electrical power"*** by Soni, Gupta, Bhatnagar.

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EE -711: PROJECT WORK - I

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	4	2	50	50	100	-

COURSE OBJECTIVE:

To expose students to simulate real life situations related to electrical engineering and carry out a design project in one of the specializations of electrical engineering with substantial multidisciplinary component.

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EE - 712: INDUSTRIAL PRACTICAL TRAINING

(Training to be undergone after VI semester)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	0	2	50	50	100	-

COURSE OBJECTIVE:

To expose students to simulate real life situations related to electrical engineering in different organizations.

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EE-713: ELECTRICAL SIMULATION LAB-III

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	2	1	30	20	50	3hrs

Practicals as per the topics in the syllabus for the course will be conducted in the laboratory. Following is the suggested list of practicals out of which a minimum of 6-7 experiments must be performed by a student during the semester. Experiments can be performed by means of mat lab software or E-Tap software (Mi-Power).

LIST OF THE EXPERIMENTS TO BE PERFORMED:

1. This Programme illustrates the use of different line model sending end voltage, sending end current calculation for short medium and long transmission line by taking examples.
2. Y-bus by Singular Transformation from a y-bus primitive matrix
3. Gauss-Siedelmethod of load flow analysis.
4. Newton-Raphson, optimum loading for generator.
5. Optimum unit commitment by Brute Force technique method.
6. Economic load dispatch by γ-iteration method.
7. Economic load dispatch by dynamic programing method.

Use Mi-Power software to perform the experiments given below:

8. Study of shunt faults of Single line diagram of power system
9. Study of load flow technique methods of power system network.

Text book:

1. ***"Matlab - Modelling, Programming and Simulations"***, Published by Sciyo, Croatia Edited by Emilson Pereira Leite.
2. ***"Modern power system analysis"*** by D.P. Kothari and I.J. Nagrath.

SEMESTER-VIII
EE-803: POWER SYSTEM PLANNING

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

After the learning of course students should be able to design transmission line, to design primary and secondary distribution also the basic concepts of generation planning. Transmission planning and distribution planning.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Objectives Of Planning:** Long and short term planning. Load forecasting, characteristics of loads, methodology of forecasting energy forecasting, peak demand forecasting, totalforecasting annual and monthly peak demand forecasting.	9
II	**Load Forecasting Objectives Of Forecasting:** Load growth patterns and their importance in planning, load forecasting Based on discounted multiple regression technique, weather sensitive load forecasting, determination of annual forecasting, use of AI in load forecasting.	10
III	**Expansion Planning:**Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.	10
IV	**Distribution System Planning Overview:** Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.	10

Text Books:

1. R.L. Sullivan, ***"Power System Planning",*** Tata McGraw Hill Publishing Company Ltd, 2012.
2. X. Wang & J.R. McDonald, "***Modern Power System Planning***", McGraw Hill Book Company,1994.
3. T. Gonen, ***"Electrical Power Distribution Engineering",*** McGraw Hill Book Company, 1986.

EE-804: DIRECT ENERGY CONVERSATION

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

To analyse the working principle, pros and cons of conventional energy conversion techniques, direct energy conversion system,need of energy storage system and fuel cell.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	Introduction toConventional generation**,** alternative generation processes, criteria for central power generation. **Thermionic Generation:**The basic thermionic diode generator and its analysis, Cross held devices, Anode and cathode materials, Experimental thermionic generator.	**10**
II	**Mhd Generation:** Principles of MHD generation, electrical conditions, FaradayGenerator, Hall generator, comparison of generators. **Experimental Mhd Generation:** Open cycle working, closed cycleOperation, Liquid metal systems, and alternating current system.	**10**
III	**Fuel Cells:**Principles of fuel cells, Thermodynamics of the fuel cell, Choice of fuels and operating condition, Polarization and its effect, Practical Fuel cells – various types. **Further Conversion Process:** Miscellaneous techniques – radiation cell, ferromagnetic generation, ferroelectric generation, controlled thermo nuclear reactions, Practical devices.	**10**
IV	**Thermoelectric Generation:** See back effect, Peltier effect, Thomsoneffect, EMF relationship, Generator analysis, Material selection, ExperimentalThermoelectric generation.	**10**

Text Books:

1. "***Direct Energy Conversion",*** by R.A.Coombe.

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EC-804: DIGITAL IMAGE PROCESSING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3 hrs

COURSE OBJECTIVE:

To learn and understand the fundamentals of digital image processing, and various image transforms, image enhancement techniques, image restoration techniques and methods, image compression and segmentation used in digital image processing.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals**: Introduction, origin, areas of image processing, steps in digital image processing, components of image processing system, basic concepts of sampling and quantization, representing digital images,spatial and gray level resolution, aliasing, zooming & shrinking digital images, neighboring of pixels, some basic relationships between pixels.	**8**
II	**Image Enhancement:** Histogram equalization,histogram specification,local enhancement, image subtraction, image averaging, basics of spatial filtering, smoothing spatial filters, sharpening of filters. **Image Restoration**: A model of the image degradation/ restoration process noise models.	**9**
III	**Wavelets**: Wavelet functions, wavelet transformations in one and two dimensions,wavelet series expansions,discrete wavelet transform,continuous wavelet transform,series expansion,scaling functions, wavelet functions, haar transform,sub band coding.	**9**

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IV	**Image Compression:**Need for data compression, image compression models, error free compression-variable length coding, LZW-coding,bit plane coding,lossless predictive coding, lossy compression-lossy predictive coding,transform coding,wavelet coding. **Image Segmentation:**Point detection,link detection**,**edge detection, ,local processing ,global processing via hough transform ,thresholding foundation ,the role of illumination,basic global thresholding,basic adaptive thresholding, region based segmentation.	**8**

Text Books:

1.Rafael C. Gonzalez, Richard E. Woods,***Digital Image Processing,*** Pearson.
2. Pratt, W. K. ***Digital Image Processing***, John Wiley.

Reference Books:

1. Jain, A.K. Englewood Cliffs***, fundamentals of Digital Image Processing***, Prentice Hall.
2. Rosenfield, A and Kak, A.C., ***Picture Processing***, Academic Press N. Y.

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EE-806: POWER SYSTEM STABILITY

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This course deals with the development detailed models of power system components and their application in the analysis of the dynamic behaviour of inter-connected power system in response to small and large disturbance.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Load Flow Studies:** Network model formulation, Formation of Y-Bus by singular transformation, load flow problem, gauss-siedel method, Newton-Raphson method, decoupled load flow method**.**	**10**
II	**Fault Analysis:** symmetrical component phase shift in star delta transformer, sequence impedance of transmission lines, sequence impedance of power system, symmetrical component analysis of unsymmetrical component.L-Gfault, L-Lfault, L-L-Gfault, L-L-L fault.	**9**
III	**Stability:**Dynamicsof synchronous machine, power angle equation, nodal elimination technique, steady state stability, transient stability, equal area criteria, numerical solution of swing equation, factors affecting transient stability.	**10**
IV	**Voltage Stabilty:** Comparison of angle and voltage stability, reactive power flow and voltage collapse, voltage stability problem and its prevention.	**10**

Text Books :

1. ***"Power Generation, Operation and Control***"by A. J. Wood and B. F. Woolenberg, Willey & son's publication.
2. ***"Power System Engineering"*** by D. P. Kothari and I. J. Nagrath TMH publication.
3. ***"Electrical Power System"*** by C.L.Wadhwa.

Reference Books:

1. ***"Power System Analysis Design"*** By B. R. Gupta.

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EE-807: OPTIMIZATION TECHNIQUES

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

Students should be educated the importance of optimal use of resources using mathematical programming methods considering all constraints and fulfilling objective of the customer.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Introduction:** Engineering Application, Statement of the Optimal Problem, Classification, Optimization Techniques. **Classical Method:** Single Variable Optimization; Multivariable Optimization without any constraints with equality and inequality constraints.	10
II	**One-Dimensional Minimization Methods:** Uni-modal Function; Elimination Method, Dichotomous Search, Fibonacci and Golden Method, Interpolation Method, Quadratic and Cubic Interpolation Method. **Unconstrained Minimization Method**: Uni-variate, Conjugate Directions, Gradient and Variable Matrix Method.	10
III	**Constrained Minimization Method:** Characteristics of a constrained problem, Direct Method of feasible directions, Indirect Method of interior and exterior penalty functions. **Geometric Programming:** Formulation and Solutions of Unconstrained and Constrained geometric programming problem.	10

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IV	**Dynamic Programming**: Concept of Sub-optimization and the principal of optimality: Calculus, Tabular and Computational Method in Dynamic Programming: An Introduction to Continuous Dynamic Programming. **Integer Programming:** Gomory's Cutting Plane Method for Integer Linear Programming; Formulation & Solution of Integer Polynomial and Non- Linear problems.	**9**

Text Books:

1. "***Optimization (Theory & Application)***- S.S. Rao, Wiley Eastern Ltd, New Delhi.
2. "***Optimization Concepts and Applications in Engineering"*** – Ashok D.Belegundu and Tirupathi R Chandrupatla – Pearson Education 1999, First India Reprint 2002

Reference Books:

1. ***Optimization: Theory andPractice***, C.S.G. Beveridge and R.S. Schechter, McGraw Hill, New York.
2. Kalyanamoy Deb, "***Optimization for Engineering design algorithms and Examples***", Prentice Hall of India Pvt. Ltd. 2006.
3. Rao, Singaresu, S., "***Engineering Optimization – Theory & Practice***", New Age International (P) Limited, New Delhi, 2000.

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EE-808: ADVANCED POWER ELECTRONICS

Teaching and Examination Scheme:

Teaching Scheme			Credit	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
3	0	0	3	40	60	100	3hrs

COURSE OBJECTIVE:

This subject introduces about inverter application and different types of dc and ac single phase and three phase drive operation by power electronics devices.

COURSE CONTENT:

UNIT	CONTENT	NO. OF HOURS
I	**Inverters:** voltage control of single phase inverter, reduction of harmonics output voltage, Switched mode power supply.	**10**
II	**DC Drive:** Single phase & three phase half wave, semi convertor, full wave dual convertor three phase. **Chopper Drives:** Power control or motoring control, regenerative braking control, two quadrant chopper drives, four quadrants chopper drives.	**10**
III	**Speed Control Of Three-Phase Induction Motors:** Stator voltage control, Stator frequency control, stator voltage and frequency control, stator current control, stator rotor resistance control, slip power recovery schemes.	**9**
IV	**Synchronous Motor Drives:** Cylindrical rotor motors, salient pole motors, reluctance motors.	**9**

Text Books:

1. ***"Power Electronics: Circuits, Devices & Applications"*** by M.H. Rashid, Prentice Hall of India Ltd,2004.
2. ***"Power Electronics***", by P.S. Bimbhra,Khanna Publishers,2006.
3. ***"Power Electronics",*** by M.D. Singhand K.B. Khanchandani, TataMC-GrawHillPub,2005.

EE-801: PROJECT WORK - II

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	T	P/D	C	Sessional	End Semester Exam	Total	
0	0	16	8	50	50	100	3 hrs

COURSE OBJECTIVE:

To simulate real life situations related to electrical engineering and impart adequate training so that confidence to face and tackle any problem in the field is developed in the college itself.

PROCEDURE:

1. The project work started in the seventh semester will continue in this semester. The students should complete the project work in this semester and present it to the assessing committee (as constituted in the seventh semester). The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester.
2. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc. There shall be at least an Interim Evaluation and a final evaluation of the project in the 8thsemester.
3. Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each student is expected to prepare a report in the prescribed format, for final evaluations based on the project work. Members of the project group will present the relevance, design, implementation, and results of the project to the project evaluation committee. Each group will submit the copies of the completed project report signed by the guide to the department.
4. The head of the department will certify the copies and return them to the students. One copy will be kept in the departmental library and one by the respective guide. The assessment committee and project guides will award the marks for the individual students in a project as follows:

   50% of the marks is to be awarded by the guide and
   50% by the evaluation committee.

   Internal Continuous Assessment:
   40% - Data collection, Planning/ Design and detailing/Simulation and analysis
   30% - Presentation & demonstration of results
   20% - Report
   10% - Regularity in the class

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EE-802: INDUSTRIAL PROJECT

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration of End Semester Examination
L	**T**	**P/D**	**C**	**Sessional**	**End Semester Exam**	**Total**	
0	0	16	8	50	50	100	3 hrs.

Note: Industrial Project of Four months duration is to be carried out by the student in industry under the joint supervision of faculty advisers from institution as well as from the industry

Suggested List of projects:

1. Any productive project involving application of engineering fundamentals to solve problems encountered by human kind, in collaboration with industry, R&D institutes, institutes of international/national/state importance as deemed fit by the faculty members/concerned supervisor.

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