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

CURRICULUM (CBCS)

ELECTRICAL & ELECTRONICS ENGINEERING

(3^{rd} to 8^{th} Semester)

Teaching and Examination Scheme

Dean
H.P. Technical University
Hamirpur - 177001

SCHEME OF TEACHING AND EXAMINATION
B.TECH -ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – III

S. N.	Categ.	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	EC-301	Analog Electronics	3	1	0	4	40	60	100
4	PC	EC-302	Digital Electronics	3	1	0	4	40	60	100
5	PC	EC-303	Network Analysis & Synthesis	3	0	0	3	40	60	100
6	PC	EEE-301	Electrical & Electronic Measurements	3	1	0	4	40	60	100
7	OE	-	Open Elective-I	2	0	0	2	40	60	100
Labs:										
1	PC	EC-305	Analog Electronics Lab	0	0	2	1	30	20	50
2	PC	EC-306	Digital Electronics Lab	0	0	2	1	30	20	50
3	PC	EEE-311	Electrical & Electronic Measurements Lab	0	0	2	1	30	20	50
			Total	**17**	**6**	**7**	**24+2**			

OPEN ELECTIVE I

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

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B.TECH -ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – IV

S. N.	Categ.	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	Humans Values & Professional ethics	2	2	0	3	40	60	100
3	PC	EEE-401	Electrical Machine	3	1	0	4	40	60	100
4	PC	EEE-402	Power System	3	1	0	4	40	60	100
5	PC	EEE-403	Power Electronics	3	1	0	4	40	60	100
6	PC	EEE-404	Electromagnetic Field Theory	3	0	0	3	40	60	100
7	OE	-	Open Elective-II	2	0	0	2	40	60	100
Labs:										
1	PC	EEE-411	Electrical Machine Lab	0	0	2	1	30	20	50
2	PC	EEE-412	Power Electronics Lab.	0	0	2	1	30	20	50
3	MC	EE-413	Electrical Simulation Lab-I	0	0	2	1	30	20	50
			Total	**16**	**8**	**7**	**24+2**			

OPEN ELECTIVE II

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

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SEMESTER – V

S. No.	Categ.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PC	EEE-501	Microprocessor Architecture and Interfacing	3	1	0	3	40	60	100
2	PC	EEE-502	Switchgearand Protection	3	1	0	4	40	60	100
3	PC	EEE-503	Electrical Machines -II	3	1	0	4	40	60	100
4	PC	EEE-504	Signals & Systems	2	2	0	3	40	60	100
5	PC	EEE-505	Transducers and Signal Conditioning	3	1	0	3	40	60	100
6	PC	EEE-506	Communication Systems	3	1	0	3	40	60	100
7	OE	-	Open Elective-III	2	0	0	2	40	60	100
Labs:										
1	PC	EEE-511	Electrical Machines -II Lab	0	0	2	1	30	20	50
2	MC	EEE-512	Switchgear and Protection &Microprocessor Lab	0	0	3	2	30	20	50
3	PC	EEE-513	Signals & Systems Lab	0	0	2	1	30	20	50
			Total	**18**	**6**	**7**	**24+2**			

OPEN ELECTIVE III(For Students of Other Departments)

S. N.	Categ.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	OE	EEE-508	Non-Conventional Electrical Power Generation	2	0	0	2	40	60	100
2	OE	EEE-509	Electrical & Electronics Engg. Materials and their applications	2	0	0	2	40	60	100
3	OE	EEE-510	Design of Hydro Power Station	2	0	0	2	40	60	100

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SEMESTER – VI

S. N.	Categ.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	EEE-601	Control Engineering	3	1	0	4	40	60	100
2	PC	EEE-602	Energy Auditing and Management	3	1	0	4	40	60	100
3	PC	EC-604	Digital Signal Processing	3	1	0	3	40	60	100
4	PC	EEE-603	Electric Drives	3	0	0	3	40	60	100
5	PC	EEE-604	Estimation and costing Practice	2	2	0	3	40	60	100
6.	PC	EEE-605	Embedded Systems	3	1	0	3	40	60	100
7	PE	-	Programme Elective – I	3	0	0	3	40	60	100
Labs:										
1	PC	EEE-611	Control Engineering Lab	0	0	2	1	30	20	50
2	PC	EEE-612	Digital Signal Processing & Embedded Systems Lab	0	0	2	1	30	20	50
3	MC	EEE-613	Seminar	0	0	2	1	50	50	100
			Total	**17**	**6**	**6**	**23+3**			

PROGRAM ELECTIVE-I

S. N.	Categ.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	EEE-608	Power System Operation & Control	3	0	0	3	40	60	100
2	PE	EEE-609	Soft Computing	3	0	0	3	40	60	100
3	PE	EEE-610	Digital Communication	3	0	0	3	40	60	100

Industrial /Practical Trainingafter VIth Semester of **six weeks** duration

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SEMESTER – VII

S. N.	Categ.	Course Code	Subject	Teaching Hours Per Weak			Credits	Examination		
				L	T	P/D		I. A Marks	ESE Marks	Total Marks
1	PC	EEE-701	Power System Analysis	3	1	0	4	40	60	100
2	PC	EEE-702	Modern Control Systems	3	1	0	4	40	60	100
3	PC	EEE-703	High Voltage Engineering	2	2	0	3	40	60	100
4	PC	EEE-704	Microelectronics and Integrated Circuits	3	0	0	3	40	60	100
5	PE	-	Program Elective-II	3	0	0	3	40	60	100
Labs:										
6	MC	EEE-711	Project Work –I	0	0	4	2	50	50	100
7	PC	EEE-712	Industrial /Practical Training	0	0	0	2	50	50	100
8	MC	EEE-713	Power System Analysis Lab	0	0	3	2	30	20	50
			Total	**12**	**3**	**11**	**20+3**			

PROGRAM ELECTIVE-II

S. N.	Categ.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	EEE-708	Wireless Communication	3	0	0	3	40	60	100
2	PE	EEE-709	Deregulation of Power System	3	0	0	3	40	60	100
3	PE	EEE-710	Power Plant Engineering	3	0	0	3	40	60	100

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B.TECH: ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – VIII

S. N.	Categ.	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	EEE-807	Project Work - II	0	0	16	8	50	50	100
			Total	6	0	16	8 + 6			
OR										
4	MC	EEE-808	Industrial Project	0	0	16	8	50	50	100
			Total	**0**	**0**	**16**	**8**			

PROGRAM ELECTIVE III

S. N.	Categ.	Subject Code	Title	Teaching Hours Per Week			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	EEE-802	Electric Power Utilization	3	0	0	3	40	60	100
3	PE	EC-804	Digital Image Processing	3	0	0	3	40	60	100

PROGRAM ELECTIVE IV

S. N.	Categ.	Subject Code	Title	Teaching Hours Per Week			Credits	Examination		
				L	T	P/D		I.A Marks	ESE Marks	Total Marks
1	PE	EEE-804	Advanced Power Electronics	3	0	0	3	40	60	100
2	PE	EEE-805	Flexible AC Transmission System	3	0	0	3	40	60	100
3	PE	EC-801	Biomedical Engineering	3	0	0	3	40	60	100

Note: Industrial Project of four months 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, Hyper geometric, 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 of demand **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-payment compound 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	**8**

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	balance sheet. **Marketing Management:** Basic concepts of marketing environment, marketing 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 &Srivastva B.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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EC-301:-ANALOG 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	**Semiconductor diodes:** Diode specifications, Diode resistance, Diode junction capacitance, Diode equivalent circuits, Load line analysis of diode circuit, Diode types: Zener, Backward, Varactor, Step recovery, Schottky, Tunnel. **Low frequencyBJT analysis:** Simplified & complete h-parameter analysis for CB, CE and CC & configuration, Calculation of CB, CE & CC parameters using h-parameters.	9
II	**Multistage amplifier:** General cascaded system, RC coupled amplifier and its frequency response, Merits and demerits, Transformer coupled amplifier,Cascode amplifiers, Darlington pair amplifiers, Effect of frequency on multistage amplifier stages. **High frequency analysis of BJT:** High frequency model for CE amplifiers, Approximate CE high frequency model with resistive load, CE short circuit gain.HF current gain with resistive load.	9
III	**Large signal amplifiers:** Analysis and design of Class A, B, AB amplifiers; Class A, B, AB Push Pull amplifiers, Merits & demerits, Distortion calculations. **Tuned amplifiers:** General behaviour of tuned amplifiers, Advantages and disadvantages of tuned amplifiers. Single tuned amplifiers, Frequency response of single tuned amplifiers,Staggered tuned amplifier.	9
IV	**Feedback amplifiers:** Introduction, Characteristics of negative feedback, Feedback topologies: Voltage series, Voltage shunt, Current series and Current shunt. **Optoelectronic devices:** Photo sensors, Photo conductor, Photodiodes, Photo transistor, LED, LCD, OLEDs, Plasma display, Field emission displays, Electronic ink displays, Opto-couplers.	9

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Text Books

1. Electronic Devices & Circuits, A.K.Maini, Wiley.
2. Basic Electronics and Linear Circuits, N.N. Bhargava, S.C.Gupta, D.C.Krlshreshtha, TMH
3. Electronic Devices & Circuit Theory,Boylestad, Pearson

Reference Books

1. Electronic Devices & Circuits, I.J.Nagrath, PHI.
2. Electronic Devices &Circuits,Salivahnan, TMH.
3. Fundamental of Electronics, Thomas, Morgan & Claypool Publishers.

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.	9
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 Five variable maps;The tabulation method, Determination of prime implicants, Selection of essential prime implicants. **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,Halfsubstractor,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.	9
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	9

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	memory and Dynamic memory. Programmable logic arrays, Charged-coupled device memory	

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

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, Fundamentalcut 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.	8
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.	8
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

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

EEE-301: ELECTRICAL & ELECTRONIC MEASUREMENTS

Teaching Scheme			Credits	Marks			Duration of 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	**Errors & Accuracy:-** Static error, Static calibration, Error calibration curve, Limiting errors, Relative limiting errors, Types of errors- Gross Errors, Systematic Errors, Random (Residual) Errors, Accuracy and precision, Static sensitivity, Linearity, Hysteresis, Threshold, Dead Time, Resolution of instrument, loading effects, Introduction to measurement standards.	8
II	**Electrical & Magnetic Measurements:-** Introduction, D'Arsonval galvanometer, moving iron & moving coil instruments, Electrodynamometer, Electrostatic Instruments, Induction type energy-meter, wattmeter. Determination of B-H curve and Hysteresis loop. **Resistance Measurements:-**Methods of measurement of low, medium and high resistance, measurement of earth resistance, localization of cable faults by Murray and Varley loop test. **Inductance and capacitance Measurements:** Measurement of inductance and capacitance by A.C. Bridge methods, Q-factor and dissipation factor. Sources of errors in bridge circuits, Shielding of bridge elements, Wagner Earthing Device.	9
III	**Measurement of Power Factor and Frequency:-**Single phase, three phase Electrodynamometer type power factor meter. Moving iron Power factor meters, Types of frequency meter, mechanical resonance type, Electrical resonance type, Ratio meter type.	8
IV	**Potentiometers:-**Basic D.C. potentiometer circuit, Modern form of D.C. potentiometer, measurement of voltage, current, Resistance and calibration of voltmeter & ammeter using D.C. potentiometer, volt ratio box, A.C. potentiometers and their applications. **Instrument Transformers:-**Introduction, Use of Instrument transformers, Ratios, Basic constructional features of C.T.and P.T., ratio & phase angle errors, Reduction of Errors.	9

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Books/References:

1)A Course of Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney, DhanpatRai& Sons, 1993.
2)Electronic Instrumentation and Measurement Techniques by W.D. Cooper & A.D. Helfrick, Prentice-Hall India.
3)Electrical Measurement & Measuring Instruments by E.W. Golding, Wheeler Publishing, 5th Edition, 1994.

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**

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	5
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	5
III	**WichtigeSprachhandlungen:** Tageszeitenverstehen und überTerminesprechen-Verabredungenverstehen–AufgabenimHaushaltverstehen. **Grammatik:** PersonalpronomenimAkkusativ und Dativ - W-Fragen "wie, wer, wohin,wo, was usw.-GenitivbeiPersonennamen - ModalverbenimPräsens "können, müssen,möchten"	5
IV	**WichtigeSprachhandlungen:** Sichaustauschen, was man kann, muss – BezeichnungenLebensmittel – Mengenangabenverstehen – PreiseverstehenundEinkaufzettelschreiben	5

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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.	**5**

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.	5
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.	5
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	5

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	andanswering questions	
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 ofone's pastime activities (sports activities), je fais du ping-pong and nasalsounds 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.	**5**
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 henceto give one directions – dialogue between two people. **Writing:**Paragraph writing describing the accommodation using the differentprepositions like en face de, derriere- to locate. **Reading Comprehension:**A text / a dialogue between two on location anddirections- ouest la poste/ la pharmacie, la bibliotheque?.....	**5**

Text Book

1. Tech French

References

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

EC-305: ANALOG ELECTRONICS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Analog Electronics Lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. To study the characteristics of different types of Diodes.
2. Find out h-parameters of BJT
3. Design and implement CE-BJT amplifier and verify various parameters
4. To study the two stage RC coupled transistor amplifier.
5. To study Class-B push pull amplifier at audio frequency.
6. To find the Efficiency of Class-A or Class AB Amplifier.
7. To plot frequency response of Single Tuned Amplifier.
8. To study the frequency response of BJT amplifier with and without feedback.
9. To study effects of Voltage Series Feedback.
10. To study effects of Voltage Shunt Feedback
11. To study modelling of circuits with optoelectronic devices using simulation software.
12. To study current voltage characteristics of LED.

NOTE : The above experiments may also be performed on simulation software

EC-306: DIGITAL ELECTRONICS LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'Digital Electronics lab.' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments:

1. To verify the truth table of logic gates realize AND, OR, NOT gates
2. To realize AND, OR gates using diodes and resistors
3. Implementation of X-OR and X-NOR using NAND and NOR gates.
4. Design of a digital circuit using K-map and realise by using NAND-NAND or NOR-NOR gates.
5. Design of an adder logic circuit.
6. Design of a subtractor logic circuit.
7. Implementation of logic equations using MUX, DEMUX
8. Design of an encoder logic circuit.
9. Design of a decoder logic circuit.
10. Conversion from one flip flop to another.
11. Design of a counter and its realization using FFs.
12. Design of a shift register and its realization using FFs.
13. Design BCD to seven-segment display using 7447 IC

NOTE: The above experiments may also be performed on simulation software

EEE-311: ELECTRRICAL AND ELECTRONICS MEASUREMENTS LAB

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

List of Experiments

1. To identify meters from the given lot.
2. To calibrate an energy meter with the help of a standard wattmeter & a stopwatch.
3. To measure power & power factor by3-Ammeter method.
4. To measure power & power factor by3-Volt meter method.
5. To measure power & power factor in3-phase circuit by2-Watt meter method.
6. To measure capacitance by DeSauty's bridge.
7. To measure inductance by Maxwell's bridge.
8. To measure frequency by Wein'sbridge.
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

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 three areas of linear programming, nonlinear programming, and classical calculus of variations. In addition to theoretical treatments, there will be some introduction to numerical methods for 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 subject to linear constraints): basic theory; simplex method; duality, practical techniques.	7
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's optimality 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.	8
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	7

	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.	**7**

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
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	6

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	in 'I' **2.** Understanding the harmony of I with the Body: Sanyam and Swasthya: correct appraisal of Physical needs, meaning of Prosperity in detail.	
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.
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.

EEE-401: ELECTRICAL MACHINE

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 back test, 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 a two winding transformer to an auto transformer, advantages & disadvantages of auto transformer, applications of auto transformer.	9
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, inrush of magnetizing current, construction of current transformers and voltage transformers, transformer cooling.	9
III	**DC Machines-I:** basic structure of electric machine, dc generator construction, equivalent circuit of dc machine, type of dc machine, 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**: Motor principle, significance of back emf, equivalent circuit of a dc motor , torque equation of dc motor, types of dc motor, characteristics of shunt, series & compound motors, speed control of dc motors, starting of dc motors & starters, losses in dc machine, efficiency of a dc machine, testing of a dc machines, application of dc machines.	**8**

Recommended Books:

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

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EEE-402: POWER SYSTEM

Teaching Scheme			Credits	Marks			Duration of 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:-** Basic structure of power system,sources of electric energy: conventional and non-conventional; cogeneration, combined heat and power, captive power plants, distributed generation	7
II	**Load characteristics and economic aspects**:- Commonly used terms and factors, curves useful in system operation and planning, economics of power factor improvement, interconnection of power stations and tariffs. **Transmission Line Performance**:- Classification of lines, models, circuit constants of transmission lines: short, medium and long lines; Ferranti effect, power flow through a line, sending and receiving, end power circle diagram, reactive power generation/absorption of line, compensation and voltage control. **Insulators for overhead transmission lines**:- Types of insulators, ratings, voltage distribution across suspension insulators, string efficiency, methods to improve string efficiency. **Mechanical Design of transmission line:-**Calculation of sag and tension, equivalent span length and sag, effect of ice and wind loading, stringing chart, sag template, conductor vibrations and vibration dampers.	9
III	**Corona and Radio interference**:- Critical voltages, corona loss, advantages and disadvantages of corona , factors affecting corona loss, effect of corona on line design, radio interference. **Insulated Cables:-**Cable conductors, insulating materials, insulation resistance, electrostatic stress in cables, grading of cables, capacitance of a three-core cable, dielectric loss, dielectric power factor, classification of cables.	8
IV	**Distribution System:-**Effect of voltage on transmission efficiency, Kelvin's law, radial and ring main distributors, interconnectors, methods of feeding distributors, ac distribution, three-phase, four wire distribution system, stepped and tapered mains.	7

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Books/References:

1) Electric Power systems by C.L. Wadhwa, New Age international, New Delhi,4th Edition,2006.
2) Electric Power generation transmission and distribution by S.N. Singh, Prentice-hall of India, Private Limited,New Delhi,2nd Edition,2008.
3) Electric Power Distribution System Engineering by TuranGonen, McGraw Hill, New York 2nd Edition, 2007.
4) A course in Electrical Power by M.L.Soni, U.S.Bhatnagar and P.V.Gupta, DhanpatRai& Sons, New Delhi, 1963
5) Elements of Power System Analysis by W.B. Stevenson McGraw Hill,4th Edition, 1982
6) Power System Engineering by D.P. Kothari and I.J. Nagrath, Tata McGraw Hill, New Delhi, ,2nd Edition,2008.

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EEE-403: POWER ELECTRONICS

Teaching Scheme			Credits	Marks			Duration of 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 power diode, power transistor, power MOSFET, SCR, GTO, TRIAC & DIAC. SCR: two transistor model, methods of turn-on, R, RC and UJT firing circuit , commutation techniques, series and parallel operation.	7
II	**Phase-controlled converters (AC to DC converters):** One, two, three, six pulse converters, fully and half controlled converters, load voltage waveforms with different types of loads, output voltage equations, continuous and discontinuous modes of operation, input power factor of converter, reactive power demand, effect of source inductance, introduction to four quadrant/dual converter.	8
III	**Cyclo converters (AC to AC converters) :** basic principle of frequency conversion, types of cycloconverter, principle of operation of step up and step down cycloconverter, single-phase to single-phase cycloconverter with resistive and inductive load. Three-phase to single-phase cycloconverter, three-phase to three-phase cyclo converter, output voltage equation of cycloconverter.	8
IV	**Choppers (DC to DC converter):** classification of choppers, principle of operation, steady state analysis of class-a choppers, step up chopper: steady state analysis, current commutated and voltage commutated chopper, output voltage control techniques, one, two and four quadrant choppers.	8

Recommended 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. Singh and K.B. Khanchandani, Tata MC Graw Hill Pub, 2005.
4. "Power Electronics: Converters, Applications and Design" by Ned Mohan, T.M. Undeland

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EEE-404 ELECTROMAGNETIC FIELD THEORY

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:-**Review of vector analysis: scalar & vector products: gradient, divergent and curl of a vector and their physical explanation Transformation amongst rectangular, cylindrical and spherical co ordinate systems.	7
II	**Electrostatics:-** Coulomb's law, electric field intensity from point charges, field due to continuous distribution of charges, Gauss's law, Electric displacement and displacement density potential function, potential field of a point charge, Laplace's and Poison's equations. **Magneto statics:-**Magnetic field intensity and magneto motive force, Ampere's Circuital law, Energy stored,BiotSavart law, vector potential, magnetic dipole.	8
III	**Time Dependent Fields:-**Ampere's work law in differential vector form, continuity of currents, conduction and displacement current. Maxwell's equations and their interpretations, boundary conditions. Wave equations, sinusoidal time varying fields, uniform plane wave in dielectric and conductor media, skin effect and depth of penetration, reflection and refraction of plane waves at boundaries for normal and oblique incidence surface impedance. **Energy Flow and Poynting Vector:-**Poynting's theorem, interpretation of E x H, simple application, complex poynting vector.	8
IV	**Guided Waves:-** (a) Transmission line theory from the circuit concept, properties; constants; transmission line equations; infinite line; reflections in transmission lines; voltage, current and impedance relations open and short circuit lines; Experimental determination of line constants. Standing wave ratio; impedance matching, quarter and half wave lines, single stub and double stub matching; circle diagram - Smith chart. (b) Waves between parallel planes: Transverse Electric waves, Transverse magnetic waves; characteristics of TE & TM waves; Transverse Electromagnetic waves; velocity of propagation; Attenuation in parallel plane guides; wave impedance.	8

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Books/References:

1) Electromagnetic waves & Radiating systems, E. Jordan, Prentice-Hall, 1950.
2) Principle and applications of Electromagnetic fields by R.Plonsey and R.E.Collin,McGraw-Hill Book Co.,New York,1961
3) Applied Electromagnetics by M.A. Planus, McGraw-Hill Book Co,1978

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

	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", "nichts".	6

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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

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
IV	Grammar and Vocabulary –the verbs: manger, boire, the partitive articles	6

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	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.	

Text Books

1. Tech French

References

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

EEE-411: ELECTRICAL MACHINE LAB

Teaching Scheme			Credits	Marks			Duration End Semester Examination
L	T	P/D	C	I.A.	ESE	Total	
0	0	2	1	30	20	50	3 hrs

Experiments as per the topics in the syllabus for the course 'PCB & Electronic workshop lab' will be conducted in the laboratory class. Following is the list of experiments out of which 8-9 experiments must be performed during the semester:

List of Experiments

INDUCTION MOTORS

1. To perform no load test & block rotor test on three-phase squirrel 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.

SYNCHRONOUS MACHINES

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

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

Recommended Books:

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

EEE-412: POWER 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

LIST OF EXPERIMENTS:

1. Experiment to study characteristics of diode, SCR and TRIAC.
2. Experiment to study characteristics of transistor and MOSFET.
3. Experiment to study R and R-C firing circuits.
4. Experiment to study UJT firing circuit.
5. Experiment to study AC phase control.
6. To study three-phase full-wave uncontrolled rectifier operation with R and R-L load and observe its input/output Wave form.
7. Experiment to study dc chopper.
8. Experiment to study single-phase cyclo converter characteristics.
9. To study single-phase full wave controlled rectifier using SCR and UJT with R and R-L load and observe its input/output Waveform with and without freewheeling (commutating) diode.
10. Experiment to study Lamp-Dimmer circuit using Diac & Triac with lamp load.

Note: At least eight experiments have to be performed in the semester from the 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	2	1	30	20	50	3 hrs

List of Experiments

1. Familiarization with electronic circuit simulation tool.

Designing with electronic circuit simulation tool.

2. Design a full wave rectifier.
3. Design a full wave bridge rectifier.
4. Design a Voltage regulator using Zener diode.
5. Design a common emitter single stage amplifier.
6. Verify the operations of OR, AND, NOT, NOR, NAND and XOR gates.
7. Design a ring counter and twisted ring counter.
8. Design a mod – 8 up and down counter.
9. Design a square wave generator using IC555 timer.
10. Design a biased diode clipper

SEMESTER -V

EEE- 501: MICROPRPOCESSOR ARCHITECTURE AND INTERFACING

Teaching and examination scheme:

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

COURSE OBJECTIVE:

The objective of the course is to gain knowledge in microprocessor architecture, programming and it's various applications to study the architecture of INTEL 8086 Assembly Language Programming and Timing Diagram instruction sets, programming and interrupt structures.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction to Microprocessors & Microcomputers:** History and Evolution, types of microprocessors, Microcomputer Programming Languages, Microcomputer Architecture. **Intel 8085 Microprocessor**: Intel 8085 Microprocessor Register Architecture. Instruction set of 8085, Instruction format, addressing modes. Memory interfacing with 8085 Processor. Interrupts in 8085 & enabling & disabling of Interrupts, Serial communication mode in 8085.	**9**
II	**Assembly Language Programming and Timing Diagram** Assembly language programming in 8085 Microprocessor timings, Micro instructions, Instruction cycle, Machine cycles , Timing diagram for different machine cycles . **Assembly level programming:** Assembly level programming for basic operations.	**8**

III	**Data Transfer Techniques & Peripherals Interfacing:** Data transfer techniques, Parallel & Programmed data transfer using 8155. Programmable parallel ports & handshake input/output, Asynchronous and Synchronous data transfer using 8251. PIC (8259), PPI (8255), DMA controller (8257). **Microprocessor Interfacing Techniques :**Interfacing Traffic Light Interface, Stepper Motor, 4 Digit 7 Segment LED , Elevator, Musical Tone Generator & 8 Channel 12Bit ADC with Multiplexor & A/D converters, D/A converters.	**9**
IV	**Architecture of Typical 16-Bit Microprocessors (Intel 8086):** Introduction to a 16 bit microprocessor, Memory address space and data organization, Segment registers and Memory segmentation, Generating a memory address, I/O address space, Addressing modes, Comparison of 8086 & 8088 . **Basic configurations of 8086/8088:**Basic configurations of 8086/8088Min. Mode, Max. Mode & System timing, Introduction to Instruction Set of 8086.	**9**

Text Books:

1. R.S. Gaonkar, "***Microprocessor Architecture, Programming & Applicationswiththe 8085/8080A"***, Wiley Eastern Ltd.
2. A.H. Mukhopadhyay,***Microprocessor, Microcomputer and Their Applications***, 3rd Edition Alpha Science International, Ltd.

Reference Books:

1. Janice GillispieMazidi, Muhammad Ali Mazidi, and Rolin D. McKinlay,***"The 8051 Microcontroller and Embedded Systems: Using Assembly and C".***
2. Kenneth L. Short, "***Microprocessors and Programmed Logic".***
3. B. S. Umashankar and K. Udaya Kumar, "***The 8085 Microprocessor: Architecture, Programming and Interfacing",***Pearson.

EEE-502: SWITCHGEAR AND PROTECTION

Teaching and examination scheme:

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

COURSE OBJECTIVE:

To introduce the students with basic concepts of Relays, Protection schemes, Switch gear and Modern trends in protection for protecting the power system equipment.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Relays**: Operating Principles, constructional features and characteristics of relays. Relay Classification, principal types of electromagnetic relays, theory of Induction relays: Shaded Pole Structure, Watt-hour meter Structure, Induction Cup Structure over current relays. **Over current relays**: Instantaneous Over current relay, Inverse time over current relay, definite time and Inverse definite minimum time relay. Introduction to Directional relays, Distance relays, Differential relays.	9
II	**Feeder Protection:** Time graded protection, current graded protection, Differential pilot wire protection, current balance and merz price voltage balance system Translay protection system, Distance protection. **Transformer Protection:** Types of faults on transformers, Transformer protection: Buchholz Protection, Differential and Biased Differential Protection. Types of faults on stator and rotor, generator protection. **Motor protection:** overload, overvoltage, over speed, prime mover failure protection.	9

III	**Static Relays**: Basic concepts, logic circuits, and Schmitt Trigger, Phase and amplitude comparator. **Differential static relays**: Static differential relay, static distance relay. **Protection against over voltages**: Ground wire, shielding angle, rod gap, horn gap, impulse gap, valve type and nonlinear arrestors, surge absorbers.	**8**
IV	**Bus bar protection**: Frame leakage or fault bus protection. **Circuit breakers**: Arc initiation and arc quenching theories, circuit breaker ratings, air circuit breaker, minimum oil circuit breaker, bulk oil circuit breaker, air blast circuit breaker, SF6 circuit breaker and vacuum circuit breaker.	**9**

Text Books:

1. *"**A course in Electrical Power"*** by Soni, Gupta, Bhatnagar.
2. *"**Power System Protection and Switchgear"*** by B.RavinderNath&M.Chander, Wiley Eastern.
3. *"**Electrical Power",**J.B.Gupta*, Katson Pubs.

Reference Books:

1. ***"Switchgear and Protection"*** by Sunil S.Rao.
2. *"**Art and Science of Protective relaying"*** by C.R.Mason, John Wiley.
3. *"**Electrical Power Systems"*** by C.L.Wadhawa.

EEE-503: ELECTRICAL MACHINES-II

Teaching and examination scheme:

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

COURSE OBJECTIVE:

To enable the students to have a fair knowledge about different types of A.C. machines and to understand the principle of operation, construction, characteristics and applications.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Three phase induction motors**: Introduction: construction, comparison of cage & wound rotors, production of rotating field, operating principle, speed & slip, rotor frequency, rotor current, relationship between rotor copper loss and rotor input, torque production, equivalent circuit, power flow diagram. **Testing of induction motor**: testing starting of induction motor, different types of starters.	**9**
II	**Three phase induction motors:** Determination of efficiency, no load and blocked rotor test, construction of circle diagram, high torque cage motors. Comparison between single cage and double cage motors, cogging and crawling, speed control of induction motors. **Single phase motors**: Introduction, production of rotating fields, principle, double revolving field theory, rotor slip, equivalent circuit, starting methods, types of single-phase Induction motors, characteristics and applications of single-phase motors.	**9**

III	**Synchronous generator**: Introduction, construction of 3-phase synchronous machines, speed and frequency, Excitation system, advantages of rotating field alternators, 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 Xd and Xq. **Parallel operation of alternators:** Synchronization of alternators by dark lamp method, Parallel operation of alternators, Alternator on infinite bus bar, Effect of change of excitation And prime mover inputs.	**9**
IV	**Synchronous motors**: Introduction, principle of operation, construction, main features, equivalent circuit and phasor diagram of a cylindrical rotor and salient pole synchronous motor, different torques in synchronous motor, power flow equation for a synchronous motor, effect of varying field currents, effect of load changes, synchronous motor V curves and inverted V curves **Starting methods of synchronous motors**: starting of synchronous motors, hunting, comparison between 3-phase synchronous and induction motors, synchronous condenser, applications of synchronous motors.	**9**

Text books:

1. "***Electrical Machines"***, AshfaqHussain, DhanpatRai, Delhi.
2. "***Electrical Machinery"***, P. S.Bhimbra, Khanna Publishers Delhi

Reference books:

1.***Electric Machinery"***, Fitzgerald & Kingsley, MGH.
2.***Electric Machines***", I.J. Nagrath and D.P. Kothari, TMH, New Delhi

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EEE-504: SIGNALS & SYSTEMS

Teaching and examination scheme:

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 OBJECTIVE:

This course is about various classifications of both continuous and discrete time signals and systems. The spectral analysis of periodic & aperiodic signals using Fourier series and Fourier transform is discussed for both CT as well as for DT signals. Analysis and characterization of the CT-LTI systems through Laplace Transform and Fourier Transform and for LTI-DT systems through Z Transform and DTFT is also discussed.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction:** Continuous time and discrete time signals, periodic signals, energy and powersignal, transformer of independent variables. **Classification of signals**: even and odd signals, exponential and sinusoidalsignal, unit impulse and unit step functions, interconnections of systems, systems with andwithout memory, causality, stability, linearity and time invariance	9
II	**Linear time invariant systems:** Introduction, discrete LTI systems, Convolution continuous time unit impulse response and convolution integral representation of LTI systems, properties ofLTI systems, Stability, causal LTI system described by difference equation, singularity functions. **Fourier series representation:** Introduction response of LTI systems to complex exponentials, Fourier series representation for continuous time periodic signals, convergence of Fourier series, properties of continuous time Fourier series, Fourier series representation of discrete time periodic signals,	9

	properties of discrete time Fourier series, Fourier series and LTI system, frequency shaping and frequency selective filters, discrete time filters.	
III	**Continuous time fourier transform:** Introduction, representation for a periodic signals, Fourier series representation of a periodic signals, convergence of Fourier transform, Fourier Transform for periodic, properties of continuous time Fourier transform, convolution and multiplication properties systems described by linear constant coefficient different equations. **Discrete time fourier transform:** Introduction representation for a periodic signals, DTFT, Fourier transform for periodic signals, convergence of the Fourier transform Gibbs phenomenon, properties of discrete time Fourier transform convolution and mortification properties, system described by linear constant coefficient difference equations.	**9**
IV	**Time and frequency characterization of signal and system:** Introduction, magnetic and phase representation of Fourier transform, magnitude and phase representation of frequency response of LTI system, Linear and nonlinear phase, group delay, log magnitude plot, time domain and frequency domain aspects of non-ideal filters 1st and 2nd order continuous time and discrete time systems. **Sampling:** Introduction, sampling theorem, sampling with zero order hold reconstruction of a signal from its samples, aliasing, sampling of discrete time signals, decimation and interpolation	**9**

Text Books:

1. ***"Signals and Systems"***, Oppenheim, Willsky& Hamid Nawab.

Reference Books:

1. *"**Digital Signal Processing"***, Proakis and Manolakis.
2. ***"Digital Signal Processing"***, Sanjit K Mitra.

EEE-505: TRANSDUCER & SIGNAL CONDITIONING

Teaching and examination scheme:

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

COURSE OBJECTIVE:

The main objective is to acquire the knowledge on different types of transducers, working principles, selection procedure applications of sensing systems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Transducers:** Definition of a transducer, basic requirements of a transducer, Basic principles of resistive transducers, Inductive transducers, capacitive transducers, Thermoelectric transducers Electrical Transducers and their classification, Transducers for measuring displacement, strain, vibration, Force, torque, pressure, flow, temperature (including Strain Gauge and L.V.D.T.) **Signal Conditioning**: Basic characteristics of instrumentation amplifier, sample andHold circuits, Digital to Analog and Analog to Digital conversion.	**9**
II	**Analog Instruments**: Electronic analog instruments for measurement of direct and alternating quantities, VTVM, Electronic Voltmeter, Electronic ohmmeter, Electronic multimeter. **Digital Instruments**: Comparison between Digital and Analog instruments, Digital voltmeter, Digital frequency meter, Digital display methods	**9**
III	**C.R.O:** Construction and synchronization of CRO , measurement of Voltage, current, phase angle and frequency using CRO, Dual trace and Dual beam	**8**

	oscilloscopes., CRT, Electrostatic deflection, CRT circuits. **Signal Analyzers**: Harmonic Distortion Analyzers, Spectrum Analyzers and their applications.	
IV	**Recorders:** Magnetic Tape recorders, X-Y recorders, Strip-Chart recorder. **Telemetry:** Principle of Telemetry, Multiplexers, Characteristics of Frequency division multiplexing, Wire Link Channels and Data Acquisition systems	**8**

Text Books:

1.***"A course in Electrical and Electronic Measurements and Instrumentation"*** by A.K.Sawhney.
2.***"Modern Electronic Instrumentation and measuring Techniques"*** by Albert D.Helfrick and William D. Cooper, PHI.

Reference Books:

1."***Electronic Measurements and Instrumentation"*** by Oliver and Cage.
2."***Digital Instrumentation"*** by A.J.Bouwens, TMH, Delhi.

EEE-506: COMMUNICATION SYSTEMS

Teaching and examination scheme:

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

COURSE OBJECTIVE:

Objective of introducing this subject to give them a description of modulation techniques which covered both the area of interest i.e. ANALOG (Real world) & DIGITAL (Imaginary world).

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
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, Frequency spectrum of AM Waves, Representations of AM, Mathematical representation of FM, Frequency spectrum of the FM waves, Phase modulation, comparison between analog and digital modulation, wide band and narrow band FM.	**9**
II	**AM Transmitters And Receivers:** 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, DSB S/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 andautomatic gain control (AGC), AM receiver characteristics.	**9**

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III	**Fm Transmitters And Receivers** **FM Transmitters**: Basic requirements and generation of FM, FM Modulation methods: Direct methods, FET reactance modulator, Transistor reactance modulation, Pre-emphasis, direct FM modulator, AFM in reactance modulation, RC Phase Shift modulation. **FM Receivers**: Limiters, single and double tuned demodulator, balanced slope detector, foster seely of phase discriminator, de-emphasis, ratio detector, block of FM receiver, RF amplifiers, FM receiver characteristics.	**9**
IV	**Introduction:** Broad overview of PCM, DM, and ADM. Review of sampling, flat top sampling, quantization, Analog to digital conversion, overview of performance of analog System over digital system. **Sampling**: Sampling theorem, frequency division multiplexing and time division multiplexing.	**8**

Text Books:

1. "***Electronic communications systems",***Kennedy/TMH
2. "***Communications systems",*** Taub&Schilling/TMH

Reference Books:

1. *" **Communication systems"**,* Simon Hawkins/John Wiley &sons
2. "***Communication systems",*** Bruce Carlson
3. "***Communication systems",*** Singh &Sapre/TMH

OPEN ELECTIVE-III

EEE-508: NON CONVENTIONAL ELECTRICAL POWER GENERATION

Teaching and examination scheme:

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:

The main objective is to explain the need of non-conventional sources of energy and their importance and discuss about various methods of generation.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction**: Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation. **Photovoltaic Effect And Solar Energy**: Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries	9
II	**MHD Generators**: Basic principles, gaseous, conduction and hall effect, generator and motor effect. **Types Of MHD**: Different types of Magneto-Hydro-Dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.	8
III	**Thermo-Electric Generators**: Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, and properties of thermoelectric material.	

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	Construction Of Thermo-Electric Generators:brief description of the construction of thermoelectric generators, application and economic aspect, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.	**9**
IV	**Fuel Cells**: Principle of action, Gibb's free energy, general description of fuel cells, types, construction, Operational characteristics and application. **Miscellaneous Sources:** Geothermal system, hydro-electric plants, wind power, tidal energy, Bio-mass energy	**8**

Text Books:

1.Gupta B. R., *"**Generation of Electrical Energy"***, S. Chand.
2. Rai, G.D., *"**Non-Conventional Energy Sources"***, Khanna Publishers (2005).
3.Rao, S. and Parulekar, B.B., Energy Technology*: "**Non-Conventional, Renewable and Conventional"***, Khanna Publishers (2005).

Reference Books:

1. Wadhwa, C.L., "***Generation, Distribution and Utilization of Electric Energy"***, New Age International (P) Limited, Publishers (2007).
2. Simon, Christopher A., ***"Alternate Source of Energy",***Rowman and LittleField Publishers Inc. (2007). 6. Venikov, V.A. and Putyain, E.V., *"**Introduction to Energy Technology"***, Mir Publishers (1990).
3.Chakrabarti A., Soni M. L., Gupta P. V. and Bhatnagar U. S., "***Power System Engineering"***, DhanpatRai and Co.

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OPEN ELECTIVE-III

EEE-509: ELECTRICAL & ELECTRONICS ENGG. MATERIALS & THEIR APPLICATIONS

Teaching and examination scheme:

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:

The main objective is to have a knowledge about conducting materials magnetic materials insulating materials and semiconductors and their main features.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Conducting Materials**: Introduction, atomic theory, Inter atomic Bonds, Resistivity and factors Affecting Resistivity, classification of conducting materials into low-resistivity and high resistivity materials. Main features and their applications. (Copper, aluminum, steel, brass, bronze, Tungsten, carbon, platinum, mercury). **Superconductors:** Superconductivity, super-conducting materials and their applications.	**8**
II	**Insulating Materials**: Introduction, General properties of insulating materials, Electrical properties, Visual properties, Mechanical properties, Thermal properties, Chemical properties, Classification-introduction, Classification of insulating materials on the basis of physical and chemical structure and their applications, Fibrous materials (Wood, Paper and card board, insulating textiles) impregnated Fibrous materials (impregnated insulating paper, varnished or impregnated textiles), non-resinous materials (bitumens,waxes).Insulating liquids: main features and their applications. (Mineral insulating oils). **Ceramic**s: main features and their applications. (Porcelain, alumina, titanates, and steatite) mica, asbestos, glass, natural and synthetic rubbers, insulating	**8**

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	resins, laminates and adhesives. Insulating gases: main features and their applications: nitrogen, hydrogen, sulphurhexafloride.	
III	**Magnetic Materials**: Permeability & Magnetic susceptibility, magnetic moment, Magnetization. Types of magnetic materials (diamagnetism, Paramagnetism, ferromagnetism),Magnetization curve, eddy current & Hysteresis losses, curie point, Magnetostriction, applications. **Types Of Magnetic Materials:**soft and hard materials:(pure iron, iron-silicon alloys, grain oriented sheet steel, magnetic anisotropy, annealing, nickel iron alloys, soft ferrites, carbon steel, tungsten steel, cobalt steel, alnico, hard ferrites).	**8**
IV	**Semiconductors**: introduction, electron energy and energy band theory, excitation of atoms-type materials, P-type materials, (Boron, Carbon, Silicon, Germanium, Phosphorus, Arsenic, Antimony, Sulphur, Selenium, Tellurium, and Iodine). Si and Ge as semi-conducting materials. **Applications**:application of semiconductor materials,Rectifiers (Germanium and Silicon rectifiers, Copper-oxide And Selenium Rectifiers). Temperature-sensitive resistors or thermistors, Photoconductive cells, Photovoltaic cell, Transistor, Hall Effect Generators, Strain Gauges	**8**

Text Books:

1.***"Electrical Engg. Materials"***,K. B. Raina, S. K. Bhattacharya, TilakJoneja, TTTI Chandigarh: Katson Pub. House New Delhi
2.***"Electrical Engineering Materials",***A.J. Dekker; PHI

Reference Books:

1. **"*Electrical and Electronics Engineering Materials"*** by Banerjee G.K
2. **"*Advanced Electrical and Electronics Materials: Processes and Applications"***by K.M. Gupta (Author), Nishu Gupta (Author)

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OPEN ELECTIVE-III

EEE-510: DESIGN OF HYDRO POWER STATION

Teaching and examination scheme:

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:

The main objective of the course is to study about the layout and planning of hydropower plant. Also to learn about the turbines, generator and the stability of hydro power plant.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Layout & Planning Of Hydro Power Plant:** Introduction, layout of power house, types of hydro power schemes, stages of investigation, PFR, DPR, hydrology, water availability and water conductor system. Penstocks, types, penstock supports, trash racks. **Power Potential Estimation Of Hydro Power Plants:** Head, dependability analysis, layout of electrical equipment's in hydro power station, selection of number of units, capacity of power plant and energy generation, and economics of the hydro power plant	8
II	**Turbines:** Introduction, types of hydraulic turbines and their suitability for power plant, governing of turbines, electro hydraulic governors, time constants of governors and their importance **Testing**: testing of hydraulic turbines, cavitation, silt erosion.	8
III	**Hydro Generators:** Introduction, construction and types of hydro generators, specifications of hydro generators, characteristics of hydro	9

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	generators **General Arrangement:** general arrangement of water wheel generators: large horizontal shaft generators, vertical and reversible generators, low speed generators, umbrella type, brakes and jacks, losses, insulation and temperature limits.	
IV	**Introduction To Generators**: Testing of generators, generator cooling and ventilation, fire protection, design of auxiliary and grounding systems, switchyard equipment, transformers and circuit breakers. **Stability Of Hydro Power Plants:** Special features of hydro power plant stability.	**8**

Text Books:

1. J. Guthrie Brown**, *"Hydro Electric Engineering"*,** Vol.I, II, III; Blackie & Son Ltd., London.Nigam, a Hand Book of Hydro Electric Engineering, Nem Chand Publishers, Roorkee.
2. B.R.Gupta, ***"Generation of Electrical Energy"***, S. Chand & Co.

Reference Books:

1. M.V.Deshpande, ***"Elements of Electrical Power Station"***, *Design*, Ah Wheeler & Co Ltd.
2. Kothari &Nagrath, ***"Electrical Machines"***, *TMH.*

EEE-511: ELECTRICAL MACHINES–II LAB

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	2	1	30	20	50	2hrs

Practical as per the topics in the syllabus for the course will be conducted in the laboratory: Following is the suggested list of practical out of which a minimum of 8-10 experiments must be performed by a student during a semester**.**

LISTOF EXPERIMENTS

Induction Motor

1) Single Phase Induction Motor

No load test and Block rotor test

2) Three phase slip ring induction motor

a) No load test

b) Block rotor test

c) Load test

3) Three phase squirrel cage induction motor

a) No load test and Block rotor test

b) Load test

4) Starting of three phase induction motor.

a) Stator resistance starting

b) Reduced voltage starting

c) Autotransformer starting

d) Star delta starting

e) Rotor resistance starting

f) Direct on line (DOL) starting

5) Cascading of two induction motors

6) Speed changing by Pole changing method

Synchronous Machine

1. To draw characteristics of alternator under different loading condition.

2. To find out regulation by synchronous impedance method.

3. To find out regulation by z.p.fmethod.

4. Synchronisation

a) To synchronize a three phase alternator with bus bar.

b) Parallel operation of two alternators.

5. V-Curves Of Synchronous Motor

a) To study the effect of variation of field current upon the stator current and p.f. with

Synchronous motor running at no load, draw the V-curves and inverted V-curves of the motor.

6. Steady State Reactances (Xd, Xq)/Slip Test

a) To measure the direct axis synchronous reactance of a synchronous machine.

b) To measure quadrature axis synchronous reactance by slip test.

7. SubtransientReactances: Xd", Xq"

a) To measure the direct axis synchronous sub transient reactance of a synchronous machine.

b) To measure quadrature axis synchronous sub transient reactance of a synchronous machine.

8. Negative Sequence Reactance: X2

a) To measure the negative sequence reactance X2 of synchronous machine.

9. Zero Sequence Reactance: X0

a) To measure the zero sequence reactance of synchronous machine.

10 Three Phase Circuit Oscillograph

a) To record the oscillogram of armature current in various phases under three-phase sudden

Short circuit.

EEE-512: SWITCHGEAR AND PROTECTION & MICROPROCESSOR LAB

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

Practical as per the topics in the syllabus for the course will be conducted in the laboratory: Following is the suggested list of practical out of which a minimum of 8-10 experiments must be performed by a student during a semester**.**

To plot time current characteristics of Electromagnetic type over-current relay.
2. To plot time-current characteristics of an IDMT relay.
3. Performance and study of Merz-Price protection.
4. Study of the performance and operation of a three phase over-current and earth fault static relay.
5. To study and plot the characteristics of impedance relay.
6. To study directional over current relay.
7. To study transformer differential protection.
8. Visit to substation and prepare layout of various equipments in the substation.

LIST OF EXPERIMENTS 8085 Based

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

2. Addition and subtraction of two 16-bit numbers. (Using 2's complement method)

3 Addition and subtraction of two 16-bit BCD numbers. (using DAA instruction.)

4 Multiplication of two 8-bit numbers using the method of successive addition and Shift & add.

5 Division of two 8-bit numbers using the method of successive subtraction and shift & subtract.

Application Based (Max 2)

1. Program controlled data transfer using 8255 PPI. A) To INPUT data bytes from peripheral port and to store them in memory. B) To OUTPUT data bytes from memory to peripheral port.

2. 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

EEE-513: SIGNALS & SYSTEMS LAB

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

List of Experiments

1. To study the process of sampling &reconstruction from sampled signal.
2. To represent the histogram of Gaussian function.
3. To study the process of pulse amplitude modulation and determine its frequency spectrum.
4. To implement quantization and encode the obtained waveform to a digital sequence.
5. To study pulse position modulation.
6. To study unipolar Non Return-to-Zero (NRZ), Polar NRZ, Unipolar Return-to-Zero (RZ), Bipolar RZ& Manchester code.
7. To study waveforms of Amplitude Shift Keying (BASK).
8. To study waveforms of Binary Phase Shift Keying (BPSK).
9. To determine spectrum of QPSK and OQPSK.
10. To determine signal space representation of QPSK.

SEMESTER VI

EEE-601: CONTROL ENGINEERING

Teaching and examination scheme:

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

COURSE OBJECTIVE:

To provide an introduction to the analysis of linear control systems. This will help to exploit time domain, frequency domain and design of linear control systems and compensators also to understand the methods to analyze the stability of systems from transfer function forms.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction**: Basic concept of automatic control, servo mechanism, regulating systems, open loop and closed loop control systems, feedback, effects of feedback, linear and non-linear control systems, Block diagrams, examples of various control systems. **Modelling**: Formulation of differential equations of linear electrical, mechanical, translational, rotational and thermal systems, electrical and mechanical analogies, use of Laplace transform and transfer function, concept of state variable modeling, block diagram algebra, signal flow graphs, characteristic equation.	**9**
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, 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.	**8**
IV	**Compensation Design**: Necessity of compensation, compensating network, phase margin, gain margin, lag and lead compensation. The Design of Feedback Control Systems: Approaches to System Design. **Types Of Compensation**: Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram	**9**

Text Books:

1. *"**Control System Engineering"** by* I.J.Nagrath&M.Gopal.
2. *"**Modern Control Engineering"*** by K.Ogata (PHI)

Reference Books:

1. *"**Modern Control System"*** by Dorf and Bishop Pub Pearson Education
2. *"**Automatic Control System"*** by B.C.Kuo (PHI)
3. *"**Control System Components"*** by J.F.Gibsen (MGH)

EEE-602: ENERGY AUDITING AND MANAGEMENT

Teaching and examination scheme:

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

COURSE OBJECTIVE:

The objective of Energy Management is to achieve and maintain optimum energy procurement and utilization, throughout the organization and to minimize energy costs / waste without affecting production & quality tominimize environmental effects.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Energy Scenario**: Basics of Energy, Energy scenario in world and India, Energy Conservation, Strategy for the Future. **The Energy Conservation Act:** Forms of Energy, Electrical Energy Basics.	8
II	**Energy Management & Audit:** Definition & Objectives of Energy Management, Energy Audit: Types and Methodology, Energy Audit Reporting Format. **Energy Usage:** Understanding Energy Costs, Benchmarking and Energy Performance, Matching Energy Usage to Requirement, Maximizing System Efficiency, Fuel and Energy Substitution, Energy Audit Instruments	8
III	**Lighting System:** Introduction, Basic Terms in Lighting System and Features, Lamp Types and their Features, Recommended Luminance Levels for Various Tasks/Activities/Locations. **Methodology Of Lighting System**: Energy Efficiency Study, Case Examples, Some Good Practices in Lighting.	9

IV	**Energy Efficient Technologies in Electrical Systems :**Maximum Demand Controllers, Automatic Power Factor Controllers, Energy Efficient Motors, Soft Starter, Variable Speed Drives, Energy Efficient Transformers, Electronic Ballasts, Energy Efficient Lighting Controls.	**8**

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Text Books:

1. *"**Handbook of Energy Audits", by*** Albert Thuman –Fairman Press Inc.
2. *"**Energy basis for man and nature",*** by Howard T.Odum&Elisbeth.C.Odum.

Reference Books:

1**. *"Energy Management",*** by UmeshRathore

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EC-604: DIGITAL SIGNAL PROCESSING

Teaching and examination scheme:

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

COURSE OBJECTIVE:

To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain. Also to study various transformation techniques, computation and about filters and design for digital implementation

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Discrete-time signals and systems** - Basic elements of a digital signal processing system, Advantages of digital signal processing, Classification of Discrete-time Signals & Systems, properties of linear time – invariant digital systems . **Introduction To The Z-Transform**:inverse Z-transform, Properties of the Z-transform, relationship between the Fourier transform and the Z-transform, Rational Z-transforms & the System function, Analysis of linear time-invariant systems in the Z-domain.	**9**
II	**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.	**9**
III	**Digital Filter Design**: Digital filter structures & design- Digital filter categories, Realization structures for FIR & IIR digital filters, Implementation	

	of digital filters: Direct form-I, Direct form-II, Cascade form and Parallel form structures for FIR and IIR filters. **General Considerations Of Digital Filter**: Designing of digital filter using window technique, Linear phase digital filters, Simple digital FIR filters : Low pass, High pass filters, Digital IIR filters : Low pass, High pass , Band pass, Band stop filters.	**9**
IV	**Digital Signal Processors**: Architecture and types of instructions, Addressing schemes and Interface details of one of the latest commonly used Digital Signal Processors (e.g. Digital Signal Processors manufactured by Texas Instruments or Analog Devices.	**8**

Text Books:

1. ***"Digital Signal Processing***", Principles, Algorithms, and ApplicationsBook by Dimitri's G. Manolakis and John G Proakis

Reference Books:

1. *"**Digital Signal Processing",*** Using MATLAB*Book* by John G Proakis and Vinay K. Ingle
2. *"**Understanding digital signal processing",*** Book by Richard G. Lyons

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EEE-603: ELECTRIC DRIVES

Teaching and examination scheme:

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 OBJECTIVE:

To understand the basic concepts of different types of electrical machines and their performance to study different methods of starting dc motor and induction motor to study the conventional and solid state drives.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction:** Introduction to an electric drive system, parts of electric drive system, choice criteria. **Dynamics Of Electric Drives:** Dynamic equations of an electric drive, torque equations, multi-quadrant operation, type of loads, energy loss during transients and load equalization.	**8**
II	**Electric Drive Control:** Control of electric drives, modes of operation, speed control, open &closed loop drives, current limit control, torque limit control, position, PLL and speed control. **Selection Of Motor Drive Rating:** Selection of motor rating – thermal model of motor, classes of duty and determination of motor rating for different classes of drive operation duty.	**9**

III	**DC Motor Drive:**Starting, braking, transient analysis, speed control, controlled rectifier converters for DC drives and chopper fed DC drives. **AC Motor Drives:** Induction motor drive – starting, braking, transient analysis, speed control, ac controller fed induction motor, voltage source inverter, current source inverter and cycloconverter fed induction motor drive.	**9**
IV	**FHP Drives:** Introduction to FHP electric drive system. Brushless DC, stepper and reluctance motor. Hysteresis motor, DC Servomotors, AC servomotors, Two-phase AC servomotor, Three-phase AC servomotors, Comparison between VR Stepper Motor and SR Motor. **Special Machines**: Hybrid Stepper Motor, Permanent-Magnet Stepping Motor	**8**

TEXT BOOKS*:*

1. ***"Fundamentals of Electrical Drives"*** *by G.K. Dubey, Alpha Science International Ltd.,2nd Edition,2001*
2. ***"Modern Power Electronics & Drives"*** *by B.K. Bose, Prentice Hall PJR,2002*
3. ***"Electric Drives-Concept and Applications"*** *by VedamSubrahmanyam, TMH Ltd., 1994.*

REFERENCE BOOKS:

1. ***"Electrical Drives",*** *G.K. Dubey, Narosa Publishing House.*
2. ***"A First Course in Electrical Drikves",*** *by S.K.Pillai, New Age International (P) Limited, 2nd Edition, 2004.*

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EEE- 604: ESTIMATION AND COSTING PRACTICE

Teaching and examination scheme:

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 OBJECTIVE:

The objective is to develop in the students the art and the skill whereby a monetary value can be placed on the volume of work previously measured to develop awareness and to analyze the influence that effect change in these factors. To encourage the habit of systematically recording all those statistics which are the stock in trade of the good estimator.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction**: Electrical symbols and standards, Indian electricity rules and acts, electrical appliances, switches and fixtures, light and fan circuit, power circuit and alarm circuits. **Electrical Diagrams:**Single line diagram, schematic diagrams, and wiring diagrams. Design and drawing of panel boards.	**8**
II	**Design Of Lighting Circuit**: Design and drawing of light and fan circuits and alarm circuits for simple, specific and emergency requirements. Alarm circuits with relays. **Illumination Engineering:** design of light schemes for hotels, parks and street lighting etc.Starting of ac motors, stopping of motors, basic control circuits.	**8**
	Introduction: load calculation, conductor size calculations, selection of energy meter, main switch, distribution board and number of circuits and sub-	**8**

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III	circuits. **Costing Of Electrical Installation:**Costing of electrical installation for small, medium residences, large installations like public buildings and commercial establishments.	
IV	**Design Of Underground & Overhead Lines:** Design, estimation and costing of HT and LT lines overhead as well as underground with complete list of material including labour charges and wastage etc. **Estimating & Costing Of Substations:** Estimating and costing of 11KV, 33KV and 66KV substation along with transformers.	**9**

Text Books:

1. **" *Electrical Design Estimating and Costing" by***: K. B. Raina, New Age International

Reference Books:

1. ***"Electrical Estimating and Costing"*** Surjit Singh, Ravi Deep Singh, DhanpatRai& Company.

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EEE-605: EMBEDDED SYSTEMS

Teaching and examination scheme:

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

COURSE OBJECTIVE:

The main objective is to introduce students to basic advance microprocessor 8086 & microcontroller 8051. Also make them familiar to current technologies such as latest processors (quad &octa core).

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction:**Introduction to microprocessors and microcomputers, Architecture of 8086 : BIU, the queue, segment registers, instruction pointer, EU. **Registers**: Flag registers, addressing modes of 8086, instruction set of 8086, RAM/ROM address decoding.	**8**
II	**Programs With An Assembler:** Program format, segment & end directives, Data & address naming directives- EQU, DB, DW, DD, assume directives. **Instructions In 8086:** Programs using 8086, conditional and unconditional jump, loop and string instructions, Interfacing of 8086 to: keyboards-alpha numeric displays and stepper motor.	**9**
III	**Microprocessor 80286:** Architecture, signal and system connection, operating modes . **Microprocessor 80386, 80486**: System and operating modes, RISC machines, optical computers.	**8**

IV	**Microprocessors and Micro controllers** **Introduction:** Microprocessors and Micro controllers, The Z80 and the 8051, four bit, Eight bit, Sixteen bit, thirty-two bit Micro controllers, Development System for Micro controllers. **The 8051 Architecture:**Introduction, 8051 Micro controller Hardware, Input/output Pins, Ports and Circuits, External Memory, Counters and Timers, Serial Data input/output, Interrupts.	**9**

Text Books*:*

1.*"**Microprocessor & interfacing program & Hardware",*** Tata McGraw Hills by D.V.Hall.

2. *"**8088/8086 microprocessor programming, interfacing, Hardware & application",***Tribel& singlePHI.

Reference Books:

1. ***"Advanced Microprocessor & interfacing"*** byB.Ram TMH
2. ***"Advanced Microprocessor and Interfacing"*** by Ram Badri .

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PROGRAMME ELECTIVE-I

EEE-608: POWER SYSTEM OPERATION AND CONTROL

Teaching and examination scheme:

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 Hours

COURSE OBJECTIVE:

The objective of this course is for students to learn modern experimental techniques in optics and photonics in the context of learning about optical fiber communication systems. Most electrical engineering students have only a minimal exposure to optics and photonics. This course provides background in this area.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Characteristics Of Power Generation Units:** Characteristics of steam units, Characteristics of hydro-units, Input Output and incremental fuel cost characteristics. **Unit Commitment:** Constraints in unit commitment, solution of the unit commitment Problem by Priority list method and Forward Dynamic Programming Approach.	8
II	**Economic Dispatch Of Thermal Units:** Economic dispatch problem, thermal System dispatching with network losses considered, Base point and participation factors, Line Loss formula (derivation not included), Solution of co-ordination equations by iteration method And Newton – Raphson method.	8
III	**Hydro-Thermal Co-Ordination:** Short term hydro – thermal scheduling problem, Solution of co-ordination equations by iteration method, Dynamic programming, dynamic Programming application to hydro-thermal problem.	8

IV	**Power System Controls:** Generator voltage control, Turbine governor control, and load Frequency control, co-ordination of economic dispatching with load frequency control.	**9**

Text Books:

1. Govind P. Agrawal, *"**Fiber Optics Communication Systems",*** John Wiley & Sons (Asia)PvtLtd.
2.Senior J. "***Optical Fiber Communications"***, Principles & Practice, PHI.

Reference Books:

1. Keiser G., *"**Optical Fiber Communication",Mc***graw-hill.
2."Fundamentals of Optical Fibre Communication" by Kumar S .

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EEE-609: SOFT COMPUTING

Teaching and examination scheme:

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 OBJECTIVE:

The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction To Neural Networks:** Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Spiking Neuron Model. **Characteristics of ANN:** McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.	**9**
II	**Essentials Of Artificial Neural Networks**: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN –Connectivity, Neural Dynamics (Activation and Synaptic). **Learning Strategy**: (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application	**8**
III	**Single Layer Feed Forward Neural Networks:** Introduction, Perceptron Models: Discrete, Continuous and Multi-Category. **Training Algorithms**: Discrete and Continuous Perceptron Networks,	**9**

	Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.	
IV	**Multilayer Feed Forward Neural Networks:** Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements. **Classical & Fuzzy Sets**: Introduction to classical sets -properties, Operations and relations; Fuzzy sets, Membership, Uncertainty Operations, properties, fuzzy relations, membership functions. : Fuzzy Logic System Components, Fuzzification, Defuzzification methods. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.	**9**

Text Book:

1. ***"Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications",*** by Rajasekharan and Rai –PHI Publication.

Reference Books:

1. ***"Introduction to Neural Networks using MATLAB 6.0",*** S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH.

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EEE-610: DIGITAL COMMUNICATION

Teaching and examination scheme:

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 OBJECTIVE:

This subject providing information regarding digital modulation techniques, along with encoding & decoding techniques used for digital communication.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Analog & Digital Communication :**Noisy communications channels, The sampling Theorem, low pass signals and band pass signals, pulse Amplitude modulation, channel bandwidth for a PAM signal, Natural sampling, Flat top sampling, signal recovery & holding, Quantization of signal, Quantization error. **Modulation:**Pulse code modulation (PCM), Delta Modulation, adaptive delta modulation. Binary phase shift keying, differential phase shift keying, differential encoded PSK, QPSK, Quadrate Amplitude shift keying (QASK) Binary frequency shift keying.	**9**
II	**Data Transmission**: Base band signal receiver, probability of error, the optimum filter, and white noise-the matched filter, probability of error of the matched filter. **Coherent Reception:** correlation, application of coherent reception in PSK and FSK. Correlation receiver for QPSK.	**9**

III	**Noise In Pulse Code**: PCM transmission, calculation of quantization noise, the O/P signal power, the effect of thermal noise, O/P signal to noise ratio in PCM. **Delta Modulation Systems**: Delta Modulation, Quantization noise in delta modulation, the O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation.	**8**
IV	**Information Coding And Decoding**: Coding for error detection and correction, Block coding – coding, anti-coding, Hamming code, Cyclic Codes. **Convolution Coding And Decoding**: Convolution coding and decoding, Shannon Fano and Hoffman Codes.	**8**

Text Books*:*

1**.** Taub& Schilling*: "**Principles of communication systems",**McGraw-Hill Education (India).
2**.** Simon Haykin*: "**Communication systems",** John-Wiley & sons, Inc.

Reference Books*:*

1**.** Couch*: "**Digital and Analog Communication Systems"*, 6th edn. Pearson Education.
2.Bernard Sklar*: "**Digital Communication"*, 2nd Edn. Pearson Education.
3.Marvin K. Simon, Sami M. Hinedi, William C. Lindsey*: "**Digital Communication Techniques".***

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EEE-611: CONTROL ENGINEERING LAB

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	2	1	30	20	50	2hrs

Practical as per the topics in the syllabus for the course will be conducted in the laboratory: Following is the suggested list of practical out of which a minimum of 8-10 experiments must be performed by a student during a semester**.**

LIST OF EXPERIMENTS

1. To Study the step response of a second order system for different damping factors.

2. To plot the speed torque characteristics of a 2 phase AC servomotor.

3. To plot the torque speed characteristics of a DC servomotor.

4. To study the closed loop control of a three phase AC motor.

5. To study the performance characteristics of a D.C. motor angular position control system.

6. To study the magnetic amplifier.

7. To Study the synchro transmitter rotor position versus stator voltages for three phase.

8. To Study the microcontroller based stepper motor controller circuit.

9. To Study various lag-lead compensation networks.

EEE-612: DIGITAL SIGNAL PROCESSING & EMBEDDED SYSTEMS LAB

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	2	1	30	20	50	2hrs

Practical as per the topics in the syllabus for the course will be conducted in the laboratory: Following is the suggested list of practical out of which a minimum of 8-10 experiments must be performed by a student during a semester**.**

LIST OF EXPERIMENTS

1. To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for discrete convolution.
3. To develop program for discrete correlation.
4. To design digital IIR filters (low-pass, high pass, band-pass, band-stop)
5. To design FIR filter using windows technique.
6. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs, push buttons).

Usage of Low Power Modes: Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current of MSP430G2 launch pad.

7.Interrupt programming examples through GPIO's.

8.PWM generation using timer on MSP430 GPIO.

9.Interfacing potentiometer with MSP430.

EEE- 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 & Electronics Engg., 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 & Electronics Engg, 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 invarious sub-fields of Electrical & Electronics Engg) 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

EEE-701: POWER SYSTEM ANALYSIS

Teaching and examination scheme:

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

COURSE OBJECTIVE:

To enable the students to gain comprehensive knowledge on power system analysis and to gain practical aspects on power system analysis problems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction**: Single line diagram of power system, Review of power system parameters andrepresentation. **Formation of ZBUS and Y BUS Matrices**:Analytical derivation of network matrices, formation of ZBUS and YBUS matrices, building algorithms	**8**
II	**Short Circuit Studies**: Review of symmetrical components, Phaseshift in star-delta transformer, Sequence Impedance of Transmission line, Transformer and Generators, Sequence Networks of power system. **Transmission Line Parameters**: Transmission lines and loads ,interconnection of sequence networksfor three phase single line to ground, line to line, double line to ground and open conductorfaults.	**9**
III	**Power Flow Studies**: The power flow problem, power flow solution by Gauss – Siedal,Newton Raphson and Fast decoupled methods. **Power Flow Controlling Methods**: Sparsity techniques, Control of power flow.	**8**

IV	**Transient Stability Studies**: The Swing equation, simplified synchronous machine model and system equivalents' **Transient Stability**: equal area criterion,numerical integration of swing equation, multi -machine stability, Design methods for improving transient stability.	**9**

Text Books:

1. *"**Modern Power System Analysis"*** by I.J.Nagrath&D.P.Kothari.
2. ***"Power System Analysis and Design with Personal ComputerApplication"*** by J.D.Glover And M.Sharma, PWS – KENT Publishing Company.

Reference Books:

1. *"**Computer Techniques to Power System Analysis"*** by M.A.Pai.
2. *"**Power System Analysis"*** by J.J.Grainger and W.D.Steverson, MGH.
3. *"**Electrical Power Systems"*** by C.L.Wadhwa.
4. *"**Power System Analysis"*** and Design by B.R.Gupta.
5. *"**Computer methods in power system analysis"*** by G.W.Stagg and A.H.Li

EEE-702: MODERN CONTROL SYSTEMS

Teaching and examination scheme:

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

COURSE OBJECTIVE:

To enable the students, to learn State variable analysis and design, to get an exposure to nonlinear systems, to understand the transfer function and state variable analysis of sampled data systems.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction**: 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 observe ability.	**8**
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	**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**: Jury's test, bilinear transformation and Schur-Cohn criteria, state space representation of discrete time systems and solution of discrete time state equations.	**9**

IV	**Non Linear Systems:** Introduction, different non-linearity's, phase plane method, singular points. **Stability of Nonlinear Systems**: construction of phase trajectories, phase plane method, concepts of describing function method, stability analysis using describing function method, Liapunov stability criterion.	**8**

Text Books*:*

1. *"**Discrete time Control Systems",*** by K. Ogata, "Prentice Hall International".
2. *"**Control System Engineering",*** by Nagrath and Gopal, "New Age International

Reference Books:

1. **"Control System"** by*B.C .Kuo*

EEE-703: HIGH VOLTAGE ENGINEERING

Teaching and examination scheme:

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 OBJECTIVE:

To get a fair knowledge about the generation, measurements of high voltages and currents, testing of high voltage apparatus.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Discharges In Gases**: General characteristics of gaseous insulation, basic processes of ionization in a gas, discharges in uniform and non-uniform fields, Paschen'slaw, 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 of lightning stroke, characteristics of lightning stroke, current and voltage magnitudes. **Protection Schemes**: Protection of transmission lines and substations against lightning, lightning arrestors, switching surges, Insulation co-ordination.	8
III	**Impulse Generator**: Definition of impulse wave, single stage and multistage impulse generators and equivalent circuits, determination of front and tail resistance to produce a given wave shapes.	9

	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.	
IV	**HVDC**: Merits and demerits of HVDC transmission systems, types of HVDC systems, bipolar,monopolar, back -to -back, Normal operation of an H.V.D.C link. **Comparison Of Ac And Dc Transmission**: application of DC transmission, HVDC system requirement, Typical layout of an HVDC substation.	**9**

Text Books:

1.***"High Voltage Engineering",*** byM.S.Naidu&V.Kamaraju.
2.***"Power System Transients and High Voltage Principles",***by B.Thapar, B.R.Gupta&L.K.Khera.

Reference Books:

1.***"High Voltage Engineering"***by C.L.Wadhwa.
2.***"A course in Electrical power"*** by Soni, Gupta, Bhatnagar.
3.***"D.C. Transmission"*** by E.W.Kimbark, Wiley Publication

EEE-704: MICROELECTRONICS AND INTEGRATED CIRCUITS

Teaching and examination scheme:

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 OBJECTIVE:

It covers the Integrated circuits, their fabrication techniques along with integrated devices (Operational amplifiers) that make them familiar with IC technology.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Integrated circuit technology**: Classification of Integrated Circuits, Monolithic technology ,Planar Processes, Fabrication of Devices-diodes. **Basic Device Physics:** Two Terminal MOS Structure: Flat-band voltage, Potential balance & charge balance, Effect of Gate-substrate voltage on surface condition, Inversion, Small signal capacitance; Three Terminal MOS Structure: Contacting the inversion layer, Body effect, Regions o f inversion, Pinch-off voltage;	**8**
II	**Four Terminal MOS Transistor**: Transistor regions of operation, regions of inversion in terms of terminal voltage, strong inversion, weak inversion, moderate inversion, interpolation models, effective mobility, temperature effects, breakdown p-channel MOS FET, enhancement and depletion type. **CMOS Device Design**: Scaling, Threshold voltage, MOSFET channel length; CMOS Performance Factors: Basic CMOS circuit elements; parasitic elements; sensitivity o f CMOS delay to device parameters; performance factors of advanced CMOS devices.	**8**

III	**Op-Amp With Negative Feedback**: Block diagram representation of feedback amplifier, voltage series feedback, voltage shunt feedback, differential amplifiers. **Frequency Response Of An Op-Amp**: frequency response, compensating network, frequency response of internally compensated op-amp and non-compensated op-amp, open loop gain vs. frequency, closed loop frequency response, circuit stability, and slew rate.	**9**
IV	**Op-Amp Applications**: Peaking amplifier, summing, scaling, averaging and instrumentationamplifiers **Converters:** voltage to current converter, current to voltage converter, very high input impedance circuit, integration, differentiation, wave shaping circuit, active filters, oscillators, comparators and 555 timer.	**8**

Text Books:

1.*"**Microelectronic circuits and devices"***by Mark N. Horenstein
2.*"**Fundamentals of microelectronics"***by BehzadRazavi

Reference books*:*

1. "***Op-amp & Linear Integrated Circuits"***, 2nd Edition by Ramakant A. Gayakward
2. ***"Linear Integrated Circuits"*** by D. R. Choudhary
3. "***Integrated Circuits"*** by K. R. Botkar

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PROGRAM ELECTIVE-II

EEE-708: WIRELESS COMMUNICATION

Teaching and examination scheme:

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 OBJECTIVE:

The main objective is getting started with evolution of wireless media & makes them skilled to various switching techniques such as Handoff's, roaming & propagation techniques etc.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction:** Evolution of wireless communication systems, Examples of wireless communication systems. **The Cellular Concept – System Design Fundamentals:** Concept of frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and grade of service, Improving coverage and capacity in cellular	**8**
II	**Propagation Models:**Free space propagation model, Macro-cell propagation model, Micro-cell propagation model, Shadowing model. **Mobile Communication**: Multipath effects in mobile communication, Models for multipath reception.	**8**
III	**Equalization:**Fundamentals of equalization, Adaptive equalizers, Linear and nonlinear equalization, Algorithms for adaptive equalization. **Diversity And Channel Coding**: Diversity techniques, Fundamentals of channel coding.	**9**

IV	**Multiple Access Techniques:**Introduction to multiple access, Frequency division multiple access, Time division multiple access, Spread spectrum multiple access, Space division multiple access, Packet radio, Orthogonal frequency division multiple access. **Wireless System:** Introduction to wireless systems and standards.	**8**

Text Books*:*

1.***"Wireless Communications: Principles and Practice"*** by Theodore S. Rappaport; Pearson / PHI Publication

Reference Books:

1.***"Wireless Communications and Networks"***3G and Beyond by ItiSahaMisra; Tata McGraw.

EEE-709: DEREGULATION OF POWER SYSTEM

Teaching and examination scheme:

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 OBJECTIVE:

To study the various role of various entities in restructured power system understand the basics of deregulation and its benefits. To know the transmission services and it's pricing and acquire knowledge on security and congestion management.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Introduction:** Basic concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, congestion management. **Components Of Deregulated System**: advantages of competitive system.	7
II	**Transmission Pricing:** Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost. **Methods**: Postage stamp method, contract path method, boundary flow method, MW mile method, MVA-mile method, Comparison of different methods.	8
III	**Deregulation Of Power Sector:** Separation of ownership and operation **Deregulated Methods**: pool model, pool and bilateral trade model, multilateral trade model, ancillary services.	8

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IV	**Congestion Management:**Interruptible load options for securitymanagement, congestion management in deregulation, economic instruments for handling congestion. **Deregulation Scenario:** England and Wales, Norway, China, California, New Zealand and Indian Power System.	**9**

Text Books:

1. ***"Understand Electric Utilities and* Deregulation"** by LorrinPhilipson and H Lee willis,CRC PRESS, 2005
2. ***"Restructured Electrical Power System operation, Trading and Volatility"*** by Mohammad
3. ***"Shahideh pour and MuwaffaqAlomous*h**", Marcel Dekker Inc, New Delhi.

Reference Books:

1. ***"Power system Restructuring and deregulation",*** edited by Loi Lei lai John Wiley & Sons Ltd.
2. ***"Power System Restructuring Engineering and Economics",*** by Marijallic, Francisco Galiana and Lestor Fink, Kluwer Academic Publisher, USA, 2000

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EEE-710: POWER PLANT ENGINEERING

Teaching and examination scheme:

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 OBJECTIVE:

The main objective is to understand the various components, operations and applications of differenttypes of power plants.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Hydro-Electric Power Plants**: Introduction, Types of dams, arrangement and location of hydro-electric station, types of hydroelectric plants and their fields of use, principle of working of a hydroelectric plant. **Types of Turbines**: their Characteristics. Draft tubes, Turbine setting, penstock dimensions.	**8**
II	**Steam Power Plant**: Introduction, Merits and demerits, site selection, working and its layout, steam turbines, fuel handling, fuel combustion and equipment, ash handling, dust collection. **Steam Power Plant Controls**,: Auxiliaries, turbo-alternators	**9**
III	**Nuclear Power Plant**: Introduction, Merits and demerits, site selection, working and its layout, nuclear reaction, nuclear fission process, nuclear chain reaction. **Nuclear Reactor And Their Functions**: Reactor control, classification of nuclear reactors, pollution and its control from nuclear power plants.	**9**
	Control Of Power Plants: Instrumentation scheme for monitoring and control	

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IV	of various parameters of power plants through control panels. Instrumentation scheme for operation and maintenance of generating units. **Automatic Load Dispatch:** Using computers. Computer based data acquisition system for power plant operations.	**9**

Text Books:

1. ***"A Course in Power Plant Engineering"*** by Arora and Domkundwar –Publisher DhanpatRai& Co.

Reference Books:

1. "A Course in electrical power" *by* J.B Gupta

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	3 hrs.

Students are expected to complete a project in groups or alone as deemed fit by the faculty and department. They should work under supervision of Faculty member/s of department, or in collaboration with other departments, or preferably with Industry. The project should demonstrate application of the fundamentals learnt during the course of study and should also be innovative. Any of the following areas may be chosen for pursuing project work.

EEE-712: INDUSTRIAL/PRACTICAL TRAINING

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	3 hrs.

Note: Industrial training of 6 weeks duration attended after 6th semester for 6 weeks during summer vacations, and evaluated in 7th semester.

EEE-713: POWER SYSTEM ANALYSIS LAB

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	3	2	30	20	50	2hrs

Practical as per the topics in the syllabus for the course will be conducted in the laboratory: Following is the suggested list of practical out of which a minimum of 8-10 experiments must be performed by a student during a semester**.**

LIST OF EXPERIMENTS

1.To study E-tap software
2. To study and draw a single line diagram of power system
3. Symmetrical fault level analysis of a multi-bus power system using soft-techniques.
4. Unsymmetrical fault level analysis of a multi-bus power system using soft-techniques for single line-to-ground faults.
5. Unsymmetrical fault level analysis of a multi-bus power system using soft-techniques for double line-to-ground faults.
6. Unsymmetrical fault level analysis of a multi-bus power system using soft-techniques for line-to-line faults.
7. Software Development for Load Flow study of power system using Gauss-Siedal Method.
8. Software Development for Load Flow study of power system using Newton-Raphson Method.
9. Software Development for Load Flow study of power system using Fast-Decoupled Method

SEMESTER VIII

PROGRAM ELECTIVE-III

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, total forecasting 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.

EEE-802: ELECTRIC POWER UTILIZATION

Teaching and examination scheme:

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 OBJECTIVE:

The purpose of this course is to enable the students to have fair knowledge about electric heating, welding, illumination, traction and their industrial applications and to understand the concept behind illumination and battery maintenance, select a particular motor for a specific application and have basic knowledge about traction system.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Electric Drives**: Electrical drives & Mechanical drives, Concept of electrical drives,Basic features of Industrial drives,review of operating. **Starting Characteristics Of Different Types Of Electric Motors:** For various drives(AC and DC motors), Estimation of rating and heating of motors.	**8**
II	**Electric Heating:** Methods of electric heating, types of electric heating, constructional details and performance of resistance heating furnace. Dielectric heating. **Welding**: Alternating current (AC).and Direct current (DC) Welding, Laser Welding.	**9**
III	**Illumination**: Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles. **Lighting Schemes**: Design of lighting schemes and Equipment used for	**9**

	indoor, industrial and flood lighting.	
IV	**Electrolysis**: Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis. **Electric Traction:** Introduction to Indian railways system, Electric Locomotive Classes, Various types of Traction system, single phase feeding arrangement prevalent in India. Substation arrangements.	**8**

Text Books:

1.BerdeM.S., *"**Electric Motor Drives"***, Khanna Publishers.
2.GuptaJ.B., *"**Utilization of Electric Power and Electric Traction"***, S.K. Kataria and Sons.

Recommended Books:

1. PartabH., *"**Modern ElectricTraction"***,DhanpatRai.
2. DeN.K. andSen P.K., "***Electric Drives"***, PHI publication.

EC-804: DIGITAL IMAGE PROCESSING

Teaching and Examination Scheme:

Teaching Scheme			Credits	Marks			Duration
L	T	P/D	C	Sessional	End Semester Exam	Total	End Semester Examination
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

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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**
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.

PROGRAM ELECTIVE-IV

EEE-804: ADVANCED POWER ELECTRONICS

Teaching and examination scheme:

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 OBJECTIVE:

The objective of the course is to impart knowledge of three-phase converters, power factor improvement techniques used in converters, Harmonic reduction techniques used in inverters, Buck and Boost dc to dc converters, three-phase ac regulator, Cyclo-converters and Multi-level inverters and their applications.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Advanced Solid State Devices**: MOSFETs, IGBT, GTO, IGCT, their power modules, intelligent power modules, thermal design, protection, gating circuits, digital signal processors used in their control. **Power Factor Correction**: Single-phase, single-stage converters (SSSSC), power factor correction at ac mains in these converters. Their application in SMPS, UPS, welding and lighting systems.	**9**
II	**Power Quality Improvement**: Improved power quality ac-dc converters such as single-phase buck, boost, buck-boost ac-dc converters. **Converters:**PWM (Pulse width modulated) based single-phase, PWM CSC (Current voltage source converters), multipulse ac-dc converters.	**8**
III	**Power Quality Mitigation Devices:** passive filters, active filters, hybrid filters.	**9**

	Reactive Power Compensation: DTSTCOM (Distribution static compensator), DVR (Dynamic voltage restorers) and UPQC (Universal power quality conditioners).	
IV	**Introduction To Motors**: Synchronous motor, permanent magnet sine fed motor, synchronous reluctance motor, permanent magnet brushless dc (PMLDC) motor. **Inverter**: LCI (load commutated inverter) fed large rating synchronous motor drives, energy conservation and power quality improvement in these drives.	**9**

Text Books:

1. N. Mohan, T. M. Undeland and W. P. Robbins, *"**Power Electronics, Converter, Applicationand Design**"*, Third Edition, John Willey & Sons, 2004.
2. *M. H. Rashid, **"Power Electronics, circuits, Devices and Applications",** Pearson, 2002, India.*
3. *B. K. Bose, **"Power Electronics and Variable Frequency Drive",** Standard Publishers Distributors, 2000.*

Reference Books:

1. R. S. Ramshaw, **"*Power Electronics Semiconductor Switches",***Champman& Hall, 1993.
2. Bin Wu, ***"High-Power Converters and AC Drives"***, IEEE Press, A John Wiley & Sons, Inc Publication, New York, 2006.
3. G. T. Heydt, ***"Electric Power Quality",***Stars in a Circle Publications, second edition, 1994, Avarua, Rarotonga, Cook Islands.
4. K. Billings, ***"Switch Mode Power Supply Handbook",*** McGraw-Hill, 1999, Boston.

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EEE-805: FLEXIBLE AC TRANSMISSION SYSTEM

Teaching and examination scheme:

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 OBJECTIVE:

To enable the students gain a fair knowledge on the concepts and technology of flexible AC transmission systems. Also to understand the need for FACTS, shunt and series compensation techniques to learn about controlled voltage and Phase angle regulator and the concept of unified power flow controller.

COURSE CONTENT:

UNIT	CONTENT	No. of Hours
I	**Fundamentals Of Ac Power Transmission**: Transmission problems and needs, emergence of FACTS-FACTS control considerations. **Facts Controllers**: Principles of shunt compensation – Variable Impedance type & switching converter type- Static Synchronous Compensator (STATCOM) configuration, characteristics and control.	**9**
II	**Static Series Compensation:** Principles of static series compensation using GCSC, TCSC and TSSC, applications, Static Synchronous Series Compensator (SSSC). **Principles Of Operation**: Steady state model and characteristics of a static voltage regulators and phase shifters- power circuit configurations.	**9**

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III	**Static Var Compensator (SVC) :**Voltage control by SVC – advantages of slope in dynamic characteristics – influence of SVC onsystem voltage. **Applications**: Enhancement of transient stability – steady state powertransfer – enhancement of power system damping – prevention of voltage instability.	**8**
IV	**UPFC**: Principles of operation and characteristics, independent active and reactive power flow control. **Comparison Methods**: comparison of UPFC with the controlled series compensators and phase shifters	**9**

Text Books :

1. Song, Y.H. and Allan T. Johns, ***"Flexible ac transmission systems (FACTS)"***, Institution of Electrical Engineers Press, London, 1999.
2. Hingorani, L.Gyugyi**"*Concepts and Technology of flexible ac transmission system*"**, IEEE Press New York, 2000 ISBN –078033 4588.
3. IEE Tutorials on **"*Flexible ac transmission systems*"**, published in Power Engineering Journal, IEE Press, 1995.

Reference Books*:*

1. Mohan Mathur, R., Rajiv. K. Varma, ***"Thyristor – Based Facts Controllers for Electrical Transmission Systems"***, IEEE press and John Wiley & Sons, Inc.
2.A.T.John, ***"Flexible AC Transmission System"***, Institution of Electrical and Electronic Engineers (IEEE), 1999.

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EC- 801: BIOMEDICAL ENGINEERING

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:

Biomedical Engineering education must allow engineers to analyze a problem from both an engineering and biological perspective. The students will be able to understand the foundations of biomedical engineering and how these are applied in the design of biomedical instruments and analysis of biological systems in the health care domain.

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals of Medical Instrumentation:** Role of technology in medicine, landmark developments in biomedical instrumentation, physiological systems of the body, sources of biomedical signals, basic medical instrumentation system, performance requirements in medical instrumentation system, intelligent medical instrumentation system, consumer and portable medical instrument, implantable medical devices, micro electro mechanical systems(MEMS).	8
II	**Medical Devices & Bioelectric Potentials:** Wireless connectivity in medical instruments, constraints in design of medical instrumentation system, regulation of medical devices, role of engineer in healthcare facilities, resting and action potentials, propagation of action potential. Physiological Potentials - Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrogastrogram (EGG), Electrooculograph (EOG) and Electroretinograph (ERG).	9

III	**Cardiovascular Measurements:** Cardiovascular system, electrocardiography, ECG recorders, blood pressure measurement, measurement of blood flow and cardiac output, measurement of heart sound, plethysmography, elements of intensive care monitoring, patient monitoring displays, diagnosis, calibration, and reparability of patient-monitoring equipment, surgical monitoring system, arterial diagnostic unit (ADU), catheterization lab, pacemakers, defibrillators.	**9**
IV	**Biotelemetry, Therapeutic And Prosthetic Devices:** Biotelemetry, physiological parameters adaptable to biotelemetry, components of biotelemetry system, implantable units, telemetry for ECG measurements during exercise, telemetry for emergency patient monitoring, audiometers and hearing aids, myoelectric arm, prosthesis configuration unit (PCU), animation control system (ACS), laparoscope, insufflators and irrigator.	**8**

Text Books:

1. Dr. O.N. Pandey, ***Fundamentals of Biomedical Instrumentation***, S.K. Kataria& Sons.
2. R.S. Khandpur,***Handbook of Biomedical Instrumentation***, Tata McGraw Hill.

Reference Books:

1. John G.Webster, ***Medical Instrumentation: Application and Design***, Wiley.
2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, ***Biomedical Instrumentation and Measurements***, Pearson.

EEE-807: 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.

Note: Project Work during last semester duration is to be carried out by the student under the joint supervision of faculty advisers from institution as well as from the industry. The work should demonstrate *higher (than previous semesters)* standards of design, analysis and fabrication capability of the student learnt during the course. The students may work in groups, as deemed fit by the faculty/supervisors.

Dean
H.P. Technical University
Hamirpur - 177001

EEE-808: 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