(A)B. Tech. Electrical Engg.& (B) B.Tech. Electrical & Electronics Engg.

Scheme of Studies/ Examination

Common Scheme for both branches (EE& EEE).

Semester III (w.e.f. session 2016-2017, K.U.K.)

S. N.	Course Code	Course Title	Teaching Schedule				Allotment of Marks				Dur. of Exam (Hrs)
			L	T	P	Hrs/Week	Theory	Sessional	Practical	Total	
1	AS-201N	Mathematics-III	3	1		4	75	25		100	3
2	EE-201N	Electronic Devices & Circuits	4	0		4	75	25		100	3
3	EE-203N	Network Analysis & Synthesis	3	1		4	75	25		100	3
4	EE-205N	Electrical Machines- I	4	1		5	75	25		100	3
5	EE-207N	Electrical Power Generation	3	0		3	75	25		100	3
6	EE-209N	Communication Systems	4	0		4	75	25		100	3
7	EE-211N	Electronic Devices & Circuits Lab			2	2		25	25	50	3
8	EE-213N	Electrical Machines -I Lab			2	2		50	50	100	3
9	EE-215N	Communication Systems Lab			2	2		25	25	50	3
10	EE-217N	Electrical Workshop			2	2		50	50	100	3
11	MPC-202N	Energy Studies*	3			3	75*	25*		100*	3
		Grand Total	24	3	8	35	450	300	150	900	

***** Energy Studies a mandatory course and student has to get passing marks in order to qualify for the award of degree but its marks will not be added in the grand total.

Common Scheme for both branches (EE& EEE).

Semester IV(w.e.f. session 2016-2017, K.U.K.)

S. N.	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Dur.of Exam (Hrs)
			L	T	P	Hrs/Week	Theory	Sessional	Practical	Total	
1	HS-201N	Fundamentals of Management	3	1		4	75	25		100	3
2	EE-202N	Digital Electronics	4	0		4	75	25		100	3
3	EE-204N	Electrical Measurements & Measuring Instruments	3	1		4	75	25		100	3
4	EE-206N	Signals & Systems	3	1		4	75	25		100	3
5	EE-208N	Electrical Machines-II	4	1		5	75	25		100	3
6	EE-210N	Electrical Engineering Materials & Processes	3	0		3	75	25		100	3
7	EE-212N	Digital Electronics Lab			2	2		25	25	50	3
8	EE-214N	Instrumentation Lab			2	2		50	50	100	3
9	EE-216N	Signals & Systems Lab			2	2		25	25	50	3
10	EE-218N	Electrical Machines-II Lab			2	2		50	50	100	3
11	MPC-201N	Environmental Studies*	3			3	75*	25*		100*	3
		Grand total	23	4	8	35	450	300	150	900	

***** Environmental Studies is a mandatory course and student has to get passing marks in order to qualify for the award of degree, but its marks will not be added in the grand total.

Note: All the students have to undergo six weeks industrial training after IV sem and it will be evaluated in V sem.

AS-201 N Mathematics-III

Lecture Tutorial Practical Major Test Minor Test Total Time
3 1 - 75 25 3H

Purpose To provide the conceptual knowledge of Engineering mathematics
Course Outcomes
CO 1 To study various fundamental concepts of Fourier series and Fourier Transformation.
CO 2 To study and understand the functions of a complex variables.
CO 3 To study the Probability Distributions.
CO 4 To study the linear programming problem formulation.

UNIT – I

Fourier Series : Euler's Formulae, Conditions for Fourier expansions, Fourier expansion of functionshaving points of discontinuity, change of interval, Odd & even functions, Half-range series.
Fourier Transforms : Fourier integrals, Fourier transforms, Fourier cosine and sine transforms.
Properties of Fourier transforms, Convolution theorem, Perseval's identity, Relation between Fourierand Laplace transforms, Fourier transforms of the derivatives of a function, Application to boundary value problems.

UNIT-II

Functions of a Complex Variables : Functions of a complex variable, Exponential function, Trigonometric, Hyperbolic and Logarithmic functions, limit and continuity of a function, Differentiability and analyticity.
Cauchy-Riemann equations, Necessary and sufficient conditions for a function to be analytic, Polar form of the Cauchy-Riemann equations, Harmonic functions, Application to flow problems, Conformal transformation, Standard transformations (Translation, Magnification &rotation, inversion & reflection, Bilinear).

UNIT-III

Probability Distributions : Probability, Baye's theorem, Discrete & Continuous probability distributions, Moment generating function, Probability generating function, Properties and applications of Binomial, Poisson and normal distributions.

UNIT-IV

Linear Programming : Linear programming problems formulation, Solution of Linear Programming Problem using Graphical method, Simplex Method, Dual-Simplex Method.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Text Book

1. Higher Engg.Mathematics : B.S. Grewal
2. Advanced Engg.Mathematics : E. Kreyzig

Reference Book

1. Complex variables and Applications : R.V. Churchil; Mc. Graw Hill
2. Engg. Mathematics Vol. II: S.S. Sastry; Prentice Hall of India.
3. Operation Research : H.A. Taha.
4. Probability and Statistics for Engineer : Johnson. PHI.

EE-201N	Electronic Devices & Circuits					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
4	0	0	75	25	100	3 Hr.
Course Outcomes						
CO1	Basics of various types of Semiconductor elements, Regulated power supply					
CO2	Model of Low & High frequency transistors, Opto-Electronics Devices					
CO3	Various types of Amplifiers, their frequency response, Power Amplifiers & applications					
CO4	Feedback Amplifiers, noise reduction, various types of Oscillators					

Unit-I

Semiconductors:
Band structure of semiconductor, Electron & hole distribution, current transport in semiconductor & concept about mobility, Diffusion & recombination, continuity equation & its solution, Hall effect.Types of P-N junction diodes: Tunnel, Zener, Shockley, Schottky, Varactor diode, Clipper & clamper ckts. (Structure & Characterstics only).

Regulated Power Supplies:
Series and shunt voltage regulators, power supply parameters, three terminals I.C. regulators, SMPS.

Unit-II

Low & High Frequency Transistors Model:
Transistor hybrid model, h-parameter of equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters in CB, CE & CC.

Basics of Opto-Electronics:
Photo-diodes, photo transistor, P-N Junction solar cells, LED, laser and photovoltaic device.

Unit-III

Amplifiers:
Small signal amplifier and mathematical analysis, RC coupled, transformer coupled, direct coupled amplifier and their frequency response, Wide band amplifier, tuned amplifier,

Power amplifiers:
Class A, class B and class C amplifier, Calculation of efficiency and harmonic distortion, push pull amplifier and application of power amplifier.

Unit-IV

Feed Back amplifiers:
Concept of +ve&-ve feedback, overall gain, advantage of –ve feedback , voltage & current feedback, series and shunt feedback, effect of feedback on frequency response and bandwidth, noise reduction using -ve feedback, effect on I/P & O/P characteristics.

Oscillators:
Barkhausen criteria, Oscillators: Wein Bridge, RC phase shift, Colpitts& Hartley oscillators, Multivibrators using transistor, crystal oscillator.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES:

1. Integrated Electronics; Miliman & Halkias; McGraw Hill.
2. Electronic circuit analysis and design (Second Ed.) D.A.V Neamen: TMH.
3. Electronics Principles: Malvino: McGraw Hill.
4. Electronics Circuits: Donald L. Schilling & Charles Belove, McGraw Hill.
5. Electronics Devices & Circuits: Boylested & Nashelsky, Pearson.

EE-203N	Network Analysis and Synthesis					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	1	0	75	25	100	3 Hr.
Purpose	To familiarize the students with the concepts of topology, transient analysis, network modeling, filters and methods of network analysis and synthesis for solving simple and complex circuits.					
Course Outcomes						
CO1	To understand the concept of N/W topologies and network analysis using graph theory.					
CO2	To understand various parameters of two port networks& their relationship					
CO3	To understand types , classification & design of filters					
CO4	To understand the concept of synthesis of one port network.					

UNIT-I

NETWORK FUNCTIONS & GRAPH THEORY: Terminal pairs or Ports, Network functions forone-port and two-port networks, concept of poles and zeros in Network functions, Restrictions on pole and zero .Locations for driving point functions and transfer functions, Time domain behaviour from the pole-zero plot. Principles of network topology, graph matrices, network analysis using graph theory.

UNIT-II

TWO PORT NETWORKS: Characteristics and Parameters of two port networks**,** Network Configurations**,** short circuit Admittance parameters, open-circuit impedance parameters, Transmission parameters, hybrid parameters, condition for reciprocity & symmetry of two-port networks in different parameters representations. Inter-relationships between parameters of two-port network sets, Expression of input & output impedances in terms of two port parameters, Inter-connection of two port networks, analysis of typical two-port networks, image impedances.

UNIT-III

FILTERS: Types of filters and their characteristics**,** Filter fundamentals, classification of Filters, Analysis& design of prototype high-pass, prototype low-pass, prototype band-pass, and prototype band-reject Filter, m-derived low-pass & high -pass filters, low -pass filter and high-pass filter with RC & RL circuits, Band pass filter with RLC circuit.

UNIT-IV

NETWORK SYNTHESIS: Hurwitz polynomials**,** Properties of Hurwitz polynomials**,** Positive real functions, procedure of testing of PR functions, concept and procedure of network synthesis, properties of expressions of driving point immitances of LC networks. LC Network synthesis: Foster's I & II Form, Cauer's I & II form, RC & RL Network.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES:

1. Network Theory Analysis & Synthesis: Smarajit Ghosh; PHI.
2.Network Analysis & Synthesis: F.F. Kuo; John Wiley & Sons Inc.
3. Circuit Theory, A.Chakarbarti, DhanpatRai
4.Introduction to modern Network Synthesis: Van Valkenburg; John Wiley.
5.Network Analysis: Van Valkenburg; PHI.
6.Networks and Systems: D.Roy Choudhury; New Age International.

EE-205N	Electrical Machines-I					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
4	1	0	75	25	100	3 Hr.
Course Outcomes						
CO1	To understand concept ,working, operation, maintenance of single phase transformer					
CO2	To understand concept ,working, operation, maintenance of three phase transformer & conversion from three phase to multiple phases					
CO3	To understand construction ,working, operation of D.C. Generator					
CO4	To understand concept ,working, operation, testing of D.C. Motor					

UNIT – I

TRANSFORMERS: Principle, construction of core, e.m.f. equation, winding &tank, cooling, operation, testing of single phase transformer, equivalent circuit, phasor diagram, parameters determination, P.U representation of parameters, regulation, losses & efficiency, separation of iron losses, parallel operation,all-day efficiency, Sumpner's test, specificationsof transformer, maintenance of transformer, difference between power transformer and distribution transformer.

UNIT – II

Three phasetransformer: Types and their comparative features, Zig-zag connection.
Auto-Transformer: Principle, construction, comparison with two winding transformers, applications.
Nature of magnetizing current: plotting of magnetizing current from B-H curve, inrush current.
Phase-Conversion: Three to two phase, three to six phase and three to twelve phase conversions. Introduction to three windings transformer, tap-changing & phase- shifting transformers.
Instrument transformer: Current transformer, Potential transformer.

UNIT – III

D.C. Generator-Principle & construction of D.C. generator, simplex lap,wave winding, E.M.F. equation, types, voltage build up, armature reaction, compensating winding, function of commutator, methods of improving commutation, load characteristics, parallel operation.
Excitation System—Purpose and requirements of excitation system, brushless excitation system.

UNIT- IV

D.C. Motor-Principle of DC motors, function of commutator in DC motors, torque and output power equations, load characteristics, losses, starting, starters, speed control, braking, testing ,Swinburne test, Hopkinson test, Ward Leonard Method, efficiency& applications.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES:

1. Electrical Machines: I.J. Nagrath and D.P. Kothari, TMH, New Dehli.
2. Performance & Design of DC Machines: A.E Clayton & N.N Hancock; ELBS.
3. Electric Machinery, Fitzerald & Kingsley, MGH.
4. Theory of alternating current machinery, A.S Langsdorf, TMH.
5. Electrical Machines, P.S. Bhimbra, Khanna Pub. Delhi.
6. Electrical Machines: Ashfaq Husain, Dhanpat Rai& company

EE-207 N	Electrical Power Generation					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	0		75	25	100	3 Hr.
Course Outcomes						
CO1	To study, Load and loading forecasting, Power plant economics, Tariffs and power factor improvement used in power generation					
CO2	To understand working of Thermal power plants, Hydro power plants					
CO3	(a)To understand working of Nuclear power plants ,Diesel power plants (b)Combined working of thermal& hydel plants.					
CO4	To make conversant with Non Conventional Energy Sources:					

Unit – I

Load and Load Forecasting:

Load curves, maximum demand, load factor, diversity factor, capacity factor, utilization factor, types of load, load forecasting, base load and peak load.

Power Plant Economics:

Choice of type of generation, size of generator and number of units, cost of electrical energy, depreciation of plant, effect of load factor on cost of Electrical Energy.

Tariffs and Power Factor Improvement:

Different types of tariffs and methods of power factor improvement.

Unit-II

Thermal Power Plants:

Choice of site,lay out, fuel-gas flow diagram, water steam flow diagram, working of power plants and their layout, characteristics of turbo generators.

Hydro power plants:

Choice of site, classification of hydro electric plants, main parts and working of plants and their layouts, characteristics of hydro electric generators.

Speed governing—Purpose, hydraulic type governor functioning

Unit-III

Nuclear power plants:

Choice of site, classification of plants, main parts, layout and their working, associated problems.

Diesel Power Plants:

Diesel plant equipments, diesel plant layout and their working, application of diesel plants.

Combined working of plants:

Advantages of combined operation plant requirements of base load and peak load operation. Combined working of run-off river plant and steam plant.

Unit-IV

Introduction to Non-Conventional Energy Sources: Elementery idea of power generation by Wind, Solar, Ocean, and Geothermal sources of energy, fuel cell, biomass.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES:

1. C.L. Wadhwa, "Electric Power System" (Willey Eastern Ltd).
2. I.J. Nagnath and D.P. Kothari "Power System Engineering" TMGH.
3. Power Genreation by B.R Gupta, S.Chand.
4. Power System Engg. By R.K Rajput, Luxmi Publication.

EE-209N	Communication Systems					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
4	0	0	75	25	100	3 Hr.
Course Outcomes						
CO1	Basics of communication & noise generation					
CO2	Amplitude modulation, concept of SSB waves & DSBSC,VSB Modulation					
CO3	Concept of TDM, FDM, PAMand Digital communication					
CO4	Concept of Pulse code modulation, differential pulse code modulation,Digital modulation Techniques					

Unit-I

Introduction to Communication Systems:
The essentials of a communication system, modes and media's of communication, introduction to wired and wireless media, classification of signals and systems, Fourier Analysis of signals.

Introduction to noise:
External noise, internal noise, S/N ratio, noise figure.

Unit-II

Amplitude modulation:
Amplitude modulation , generation of AM waves, Frequency Spectrum, Demodulation of AM waves, DSBSC, generation of DSBSC waves, single side band modulation, generation of SSB waves, demodulation of SSB waves, vestigial sideband modulation (VSB)

Angle modulation:
Basic definition, Introduction to phase modulation (PM) & frequency modulation (FM) multiplexing,

Unit-III

Pulse Modulation:
Sampling theorem &aliasing.Time division (TDM) and frequency division (FDM) multiplexing, pulse amplitude modulation (PAM), pulse width modulation (PWM). Pulse Position Modulation (PPM)

Elements of Digital Communication System:
Block diagram of digital communication system, digital representation of analog system, Advantage & disadvantage of digital communication,

Unit-IV

Pulse Digital Modulation:
Elements of pulse code modulation, noise in PCM systems, measure of information, channel capacity, channel capacity of a PCM system, differential pulse code modulation (DPCM). Delta modulation (DM).

Digital modulation techniques: ASK, FSK, BPSK, QPSK, M-ary PSK.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES :

1.CommunicationSystems (4thedn.): Simon Haykins, John Willey & sons.
2. Communication Systems: Singh &Sapre, TMH.
3. Electronic Communication Systems: Kennedy, TMH.
4. Communication Electronics: Frenzel, TMH.
5.Communication Systems: Taub& Schilling, TMH

EE-211N	Electronic Devices Ckt. Lab					
Lecture	Tutorial	Practical	External	Sessional	Total	Exam Time
		2	25	25	50	3 Hr.

LIST OF EXPERIMENTS:

1. To experimentally draw the reverse breakdown characteristics of Zener diode as a voltage regulator.
2. To draw the input and output characteristics of a given transistor in common emitter configuration.
3. To measure ac ripple factor of half wave rectifier, full wave rectifier & bridge rectifier and effect of different filter circuits at different loads.
4. To measure h- parameters of given transistorin common emitter configuration at 1 KHz.
5. To draw characteristics of photo diode & LED.
6. To draw characteristics of opto-coupler.
7. To draw characteristics of Varactor diode.
8. To determine voltage gain, power gain & freq. responseof Transformer coupled amplifier.
9. To study Hartley Oscillator.
10. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.

Note: At least ten experiments are to be performed; at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

EE-213N			Electrical Machine-I Lab			
Lecture	Tutorial	Practical	External	Sessional	Total	Exam Time
0	0	2	50	50	100	3 Hr.

LIST OF EXPERIMENTS:

1. To find turns ratio, polarity & mark dot convention of a 1-phase transformer.
2. To perform open & short circuit tests on a 1-phase transformer& find parameters.
3. To perform Sumpner's Back to Back test on 1-phase transformer& find parameters.
4. Parallel operation of two 1-phase transformers and observe load sharing.
5. To convert three phase supply to 2-phase by Scott-connection, compare line currents theoretically& practically for unbalanced load.
6. To perform load test on DC shunt generator & find efficiency& observe speed at different load.
7. Speed control of DC shunt motor by armature & field control method, draw graph between speed & field current.
8. To perform Swinburne's test of DC shunts motor and find efficiency.
9. To perform Hopkinson's test of DC shunts M/Cs.
10. To perform Ward Leonard method for speed control DC shunts motor.
11. To make various types of three phase connections ,using three single phase transformers, study relevant features
12. Characteristics for compound, series shunt generators.

Note: At least ten experiments are to be performed; at least eight experiments should be performed from above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

EE-215 N	Communication Systems lab					
Lecture	**Tutorial**	**Practical**	**External**	**Sessional**	**Total**	**Exam Time**
0	**0**	**2**	**25**	**25**	**50**	**3 Hr.**

LIST OF EXPERIMENTS:

1. To observe sampling theorem waveforms on CRO.
2. To observe AM Modulation/Demodulation waveforms on CRO.
3. To observe FM Modulation / Demodulation on CRO.
4. To observe PAM Modulation / Demodulation waveforms on CRO.
5. To observe Delta Adaptive Modulation / Demodulation waveforms on CRO.
6. To observe PCM Modulation / Demodulation waveforms on CRO.
7. To observe Carrier Modulation technique using ASK on CRO.
8. To observe Carrier Modulation technique using FSK on CRO.
9. To observe Carrier Modulation technique using PSK on CRO.
10. Comparative study of Delta Modulation & Adaptive Delta Modulation Technique on CRO.
11. To observe Time Division Multiplexing & De-multiplexing on CRO.

Note: At least ten experiments are to be performed; at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

EE-217N	Electrical Workshop					
Lecture	Tutorial	Practical	External	Sessional	Total	Exam Time
0	0	2	50	50	100	3 Hr.

LIST OF EXPERIMENTS:

1. Introduction of tools, electrical materials, symbols, and abbreviations.
2. a) To make connections of stair case wiring.
   b) To carry out house wiring using battens, cleat, casing-capping, and conduit wiring.
3. To make connections of high pressure mercury vapour lamp (H.P.M.V) and Sodium vapour lamp and study the performance.
4. Repairing of home appliances such as heater, electric iron, fans, fluorescent tube light etc.
5. To study construction of moving iron, moving coil, electrodynamics & induction type meters.
6. To design & fabricate single phase transformer.
7. To study fuses, relays, contactors, MCBs, and circuit breakers.
8. Insulation testing of electrical equipments with the help of megger.
9. To design, fabricate a PCB for a circuit, wire-up and test.
10. To study electrical Drawing of a building and prepare drawing of workshop lab.
11. a) To make connections of house hold wiring from main- using color code for phase ,earth, neutral

b) Testing of earth wire, earthing and phase wire in house hold wiring.

12. Measurement of frequency, phase angle, voltage with the help CRO and function generator.

Note: At least ten experiments are to be performed; at least eight experiments should be performed from above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

MPC-202NENERGY STUDIES

L	T	P
3	-	-

Sessional: 25 Marks
Exam: 75 Marks
Total: 100 Marks
Time: 3 hrs

UNIT-I

Introduction: Types of energy, Conversion of various forms of energy, Conventional and Nonconventional sources, Need for Non-Conventional Energy based power generation.
Energy Management: General Principles of Energy Management, Energy Management Strategy.
Energy Audit & Tariffs: Need, Types, Methodology and Approach.

UNIT-II

Conventional Energy sources: Selection of site**,** working of Thermal, Hydro, Nuclear and Diesel power plants and their schematic diagrams & their comparative advantages- disadvantages.

UNIT-III

Non Conventional Energy sources: Basic principle, site selection and power plant layout of Solar energy, photovoltaic technologies, PV Systems and their components, power plant layout of Wind energy, layout of Bio energy plants ,Geothermal energy plants and tidal energy plants.

UNIT-IV

Energy Scenario: Lay out of power system, Role of Energy in Economic development, energy demand, availability and consumption, Commercial and Non-commercial energy, Indian energy scenario, long term energy scenario, energy pricing, energy sector reforms in India, energy strategy for the future.
Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.
Suggested Text Books & References:

1. Energy Studies-Wiley and Dream tech India
2. Soni, Gupta, Bhatnagar: Electrical Power Systems – Dhanpat Rai& Sons
3. NEDCAP: Non Conventional Energy Guide Lines
4. G.D. Roy: Non conventional energy sources
5. B H Khan: Non Conventional energy resources - - McGraw Hill
6. Meinel A B and Meinal M P,Addison :Applied Solar Energy- Wesley Publications
7. George Sutton: Direct Energy Conversion - McGraw Hill

HS-201 N Fundamentals of Management

Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	1		75	25		3H

Purpose To make the students conversant with the basics concepts in management thereby leading to nurturing their managerial skills
COURSE OUTCOMES
CO1 An overview about management as a discipline and its evolution
CO2 Understand the concept and importance of planning and organizing in an organization
CO3 Enabling the students to know about the importance of hiring and guiding the workforce by understanding the concept of leadership and communication in detail
CO4 To understand the concept and techniques of controlling and new trends in management

UNIT-1

Introduction to Management: Meaning, Definition, nature, importance & Functions, Management as Art, Science & Profession-Management as social System, Concepts of management-Administration

Evolution of Management Thought: Development of Management Thought-Scientific management, Administrative Theory of Management, Bureaucratic Organization, Behavioral approach (Neo Classical Theory): Human Relations Movement; Behavioral Science approach; Modern approach to management –Systems approach and contingency approach.

UNIT-II

Planning: nature, purpose and functions, types of plans, planning process, Strategies and Policies:Concept of Corporate Strategy, formulation of strategy, Types of strategies, Management by objectives (MBO), SWOT analysis, Types of policies, principles of formulation of policies

Organizing: nature, importance, process, organization structure: Line and Staff organization, Delegation of Authority and responsibility, Centralization and Decentralization, Decision Making Process , Decision Making Models, Departmentalization: Concept and Types (Project and Matrix),formal & informal organizations

UNIT-III

Staffing: concept, process, features; manpower planning; Job Analysis: concept and process; Recruitment and selection: concept, process, sources of recruitment; performance appraisal, training and development Directing: Communication-nature, process, formal and informal, barriers to Effective Communication, Theories of motivation-Maslow, Herzberg, McGregor ; Leadership–concept and theories, Managerial Grid, Situational Leadership. Transactional and Transformational Leadership

UNIT-IV

Controlling: concept, process, types, barriers to controlling, controlling Techniques: budgetary control, Return on investment, Management information system-MIS , TQM-Total Quality Management, Network Analysis-PERT and CPM. Recent Trends in Management:-Social Responsibility of Corporate Social Responsibility (CSR) and business ethics. Functional aspects of business: Conceptual framework of functional areas of management-Finance; Marketing and Human Resources

Text books

1.Management Concepts -Robbins, S.P; Pearson Education India
2.Principles of Management -Koontz &O'Donnel; (McGraw Hill)

Recommended books

1.Business Organization and Management –Basu ; Tata McGraw Hill
2.Management and OB--Mullins; Pearson Education
3.Essentials of Management –Koontz, Tata McGraw-Hill
4.Management Theory and Practice –Gupta, C.B; Sultan Chand and Sons, new Delhi
5.Prasad, Lallan and S.S. Gulshan. Management Principles and Practices. S. Chand & Co. Ltd., New Delhi.
6.Chhabra, T.N. Principles and Practice of Management. Dhanpat Rai& Co., Delhi.
7.Organizationalbehavior –Robins Stephen P; PHI.

NOTE: Eight questions are to be set in all by the examiner taking two questions from each unit. Students will be required to attempt five questions in all, selecting at least one question from each unit.

EE-202N	Digital Electronics					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessional**	**Total**	**Time**
4	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Course Outcome						
CO1	**To understand fundamentals of Digital techniques, Binary codes**					
CO2	**To design basic circuits using Gates and MSI Devices**					
CO3	**To understand design of synchronous and Asynchronous sequential circuits A/D and D/A convertors**					
CO4	**Concept of Digital logic families, programmable logic devices**					

Unit-I

Fundamentals of Digital Techniques:

Digital signal, review of number systems, binary codes, BCD, Excess-3, Gray, EBCDIC, ASCII, logic gates- AND, OR, NOT, NAND, NOR, EX-OR, Boolean algebra, Error detection and correction, hamming code.

Unit-II

Combination Design using Gates:

Design using gates, K- map and Quine-Mccluskey methods of simplification.

Combinational design using MSI Devices

Multiplexers and Demultiplexers and their uses as logic elements, Decoders, Adders/Subtracters, BCD arithmetic circuits, Encoders, Decoders/Drivers for display devices.

Unit-III

Design of Sequential circuits:

Flip flops: S-R, J-K, T,D, master slave, edge triggered, shift registers, sequence generators, counters- asynchronous and synchronous, ring counters and Johnson Counter.

D/A &A/D Converters:

D/A converters- weighted resistor and R-2 R ladder, specifications for D/A converters, A/D converters: Sample and hold circuits, Quantization, Parallel-comparator, successive approximation, counting type, dual slope ADC, specifications of ADCs.

Unit-IV

Digital logic families:

Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, interfacing of CMOS and TTL families.

Programmable logic devices:

ROM, PLA, PAL, FPGA and CPLDS.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES:

1. Modern Digital Electronics (Edition III) : R.P. Jain, TMH.
2. Digital Integrated Electronics: Taub& Schilling, MGH
3. Digital Principles and Applications: Malvino & Leach, MGH
4. Digital Fundamentals,Floyd,11th Ed.,Pearson

EE-204N	Electrical Measurements & Measuring Instruments					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	1	0	75	25	100	3 Hr.
Course Outcomes						
CO1	To understand the concept of units, errors, measuring system fundamentals					
CO2	To understand the concept of measuring instruments					
CO3	To understand the concept of watt meters, energy meters, power factor & frequency meters					
CO4	To understand the concept of low & high resistance measurements, a.c.bridges					

UNIT – 1

UNITS, STANDARDS& ERRORS: S.I. units, Absolute standards (International, Primary, Secondary & Working Standards). True Value, Errors (Gross Systematic Random): Static characteristics of Instruments (Accuracy, precision, Sensitivity, Resolution & threshold).

MEASURING SYSTEM FUNDAMENTALS: Classification of instruments (Absolute & Secondary Instruments: indicating, recording &integrating instruments: based upon Principle of operation). Generalized instrument (Block diagram, description of blocks). Three forces in electromechanical indicating instrument (Deflecting, controlling & damping forces). Comparison between gravity & spring controls: comparison of damping methods & their suitability bearing supports, pivot-less supports (simple & taut-band). Scale information, instrument cases (covers).

UNIT – II

MEASURING INSTRUMENTS: Construction, operating principle, Torque equation, shape of scale, use as Ammeter or as Voltmeter (Extension of Ranges). Use on AC/DC or both. Advantages & disadvantages, errors (both on AC/ DC) of PMMC types, electrodynamic type, moving iron type (attraction, repulsion & combined types). Hot wire type & induction type, electrostatic type instruments. Introduction of Q meter, VTVM, B-H curve

UNIT – III

WATTMETERS & ENERGY METERS: Construction, operating principle, torque equation, shape of scale, errors, Advantages & disadvantages of Electrodynamics & induction type watt meters; single phase induction type Energy meter, Compensation & creep in energy meter.

POWER FACTOR & FREQUENCY METERS: Construction, operating principle, torque equation, advantages & disadvantages of Single phase power factor meters (Electrodynamics & moving iron types) & Frequency meters (Electrical Resonance type, Ferrodynamic & Electrodynamic types).

UNIT – IV

LOW & HIGH RESISTANCE MEASUREMENTS: Limitations of Wheat stone bridge; Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megaohm Bridge & meggar.

A.C.BRIDGES: General balance, Ckt. & Phasor diagram, applications, advantages/disadvantages of:Maxwell's inductance, inductance-capacitance, Hays, Anderson, Owens, De-Sauty's, Schering &Weins Bridges.Shielding & earthling

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES:

1. A Course in Elect. & Electronics Measurement & Instrumentation by A.K. Sawhney; Khanna Pub.
2. Electronics & Electrical Measurement & Instrumentation by J.B. Gupta, Kataria& Sons.
3. Electronics Instrumentation & Measurement technique, W.D. Copper &A.dHelfrick.
4. Measuring Systems by E.O. Doeblin; TMH.

EE-206N	Signals & Systems					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	1	0	75	25	100	3 Hr.
Course Outcomes						
CO1	Introduce and classify signals and systems based on their properties.					
CO2	To understand the basic concepts of random variables and Linear time invariant systems.					
CO3	Familiarization with the sampling process and spectral analysis of signals using Fourier series.					
CO4	Apply transform techniques to analyze continuous-time and discrete-time signals and systems					

Unit-I

Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and aperiodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation.

Introduction to Systems: Linear and non-linear systems, time invariant and time varying systems ,lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

Unit-II

Random Variables: Introduction to Random Variables, pdf, cdf, moments, distributions, correlation functions.

Linear Time Invariant Systems: Introduction to linear time invariant (LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations. Concept of impulse response.

Unit-III

Discretization of Analog Signals: Introduction to sampling, sampling theorem and its proof. Effect of under sampling, reconstruction of a signal from sampled signal.

Fourier Series : Continuous time Fourier series (CTFS), Properties of CTFS, Convergence of Fourier series, Discrete time Fourier Series (DTFS), Properties of DTFS , Fourier series and LTI system, Filtering.

Unit-IV

Fourier Transform: Continuous Time Fourier Transform (CTFT), Properties of CTFT, Systems characterized by linear constant- coefficient differential equations.

Discrete time Fourier transform (DTFT), Properties of DTFT, Duality, Systems characterized by linear constant coefficient difference equations.

Laplace Transform: Introduction to Laplace transform, Region of convergence for laplace transform, Inverse Laplace transform, Properties of Laplace transform, Analysis and characterization of LTI systems using Laplace transform, System function algebra and block diagram representations,

Unilateral Laplace transform.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES :

1. Oppenheim, Willsky, Nawab, Signals and Systems, Prentice Hall India, 2nd Edition, 2009
2. Simon Haykins – "Signal & Systems", Wiley Eastern
3. Tarun Kumar Rawat, Signals and Systems, Oxford University Press.

EE-208N	Electrical Machines-II					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
4	1	0	75	25	100	3 Hr.
Course Outcomes						
CO1	To study working & testing of three phase induction motor , special purpose induction motors ,starting methods					
CO2	To study Basic Concept of Electrical Machines and working of single phase induction motors					
CO3	To study working & testing of three phase Synchronous Generators					
CO4	To study working & testing of three phase synchronous motors					

UNIT-I

Induction Machines(A):

Basic concept of Induction machines: winding factors, generated e.m.f. and m.m.f distribution, a.c. winding, rotating magnetic field.

3-phase Induction Motor: Construction, features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque -slip characteristics, running, light and blocked rotor test, load test on 3-ph I.M.

UNIT-II

Induction Machines(B):

Effect of rotor resistance, Effect of space harmonics, deep bar and double cage 3ph-induction motor.

Starting of 3-ph I.M. Starting methods of squirrel cage and wound rotor induction motor.

Induction Generator-Operation, applications, advantages.

Single phase induction motors:-

Constructional features & double revolving field theory, equivalent circuit, determination of parameters. Split phase, starting methods, types& applications.

UNIT-III

Three Phase Synchronous Generators: Principle, construction, EMF equation, armature winding, armature reaction, equivalent circuit, voltage regulation - synchronous reactance method , Rothert's m.m.f method, Potier triangle method, Output power equation, power angle curve, two reactance theory, slip test, Transient and sub-transient reactance, synchronization, parallel operation. S.C.R. and its significance, cooling of generators

UNIT-IV

Three Phase Synchronous Motor: Construction, Principle of operation, Equivalent circuit, torque, power developed , starting, V-curve, Hunting-causes , effects &reduction , synchronous condenser applications. Comparison between induction motor and synchronous motor, high startig torque motors.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES :

1. Electrical Machines, P.S. Bhimbra, Khanna Publishers Delhi
2. Electric Machines, Ashfaq Hussain, Dhanpat Rai
3. Theory of alternating current machinery: A.S. Langsdorf (TMH)
4. Generalized theory of Electrical Machines: P.S. Bhimbra

EE-210N	Electrical Engineering Materials & Processes					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	0	0	75	25	100	3 Hr.
Course Outcomes						
CO1	To study properties of conductors and super conductors and other alloys.					
CO2	To study properties of insulators, diaelectric, semiconductor materials.					
CO3	To study properties of dia ,ferro, and paramagnetic materials					
CO4	To study various processes					

UNIT-I

Conductors, Properties of conductors, ACSR, High resistivity materials and their properties, Alloys, Soldering and brazing materials, superconductivity, super conductor materials and their applications.

UNIT-II

Insulators, classifications of insulators, dialectical materials, glass and ceramics, refractory materials and their uses, optical fibers, laser and opto-electronics materials, semiconductor materials, properties of semiconductor materials, thermosetting and thermoplast materials.

UNIT-III

Classification of material, Dia, Para, and Ferro magnetic materials-curie law and curie Weiss law (qualitative study).Ferromagnetism-Qualitative study of domain theory – Hysteresis phenomena. Hard and soft magnetic material and their applications. Ferrites, Structure and property.

UNIT-IV

Processes used in Plano technology e.g. Lapping, polishing, cleaning, masking, photolithography, diffusion, oxidation and metallization, welding, wire bonding, packaging and encapsulation, Heating- induction and dielectric, Electron beam welding and cutting, annealing, cold &Hot rolling.

Paper Setter's Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

REFERENCES :

1. SP Seth "A course in Electrical Engg. Material" (Dhanpat Rai & Sons).
2. Dekker, "Electrical Engg. Materials" (PHI).
3. PL Kapoor,"A text book of Electrical Engg. Material" (Khanna Publishers).

EE-212N	Digital Electronics Lab					
Lecture	**Tutorial**	**Practical**	**External**	**Sessional**	**Total**	**Exam Time**
0	**0**	**2**	**25**	**25**	**50**	**3 Hr.**

LIST OF EXPERIMENTS:

1) Study of TTL gates- AND, OR, NOR, NAND, NOT, EX-OR, EX-NOR.
2) Design & realize a given function using K-Map and verify its performance.
3) To verify the operation of multiplexer &Demultiplexers.
4) To verify the operation of comparator.
5) To verify the truth tables of S-R, J-K, T& D type flip flops
6) To verify the operation of bi-directional shift register.
7) To design & verify the operation of 3-bit synchronous counter.
8) To design and verify the operation of synchronous UP/DOWN decade counter using JK flip flop & drive a seven segment display using the same.
9) To design and verify the operation of asynchronous UP/DOWN decade counter using JK flip flop & drive a seven segment display using the same.
10) To design and realize sequence generator for a given sequence using JK Flip flop.
11) Study of CMOS NAND & NOR gates and interfacing between TTL and CMOS gates.
12) Design a 4-bit shift register and verify its operation of a ring counter and a Johnson counter.

Note: At least ten experiments are to be performed; at least seven experiments should be performed from above list. Remaining three experiments may either perform from the above list or designed and set by the concerned institution as per the scope of the syllabus.

EE-214N	Instrumentation Lab					
Lecture	**Tutorial**	**Practical**	**External**	**Sessional**	**Total**	**Exam Time**
		2	**50**	**50**	**100**	**3 Hr.**

LIST OF EXPERIMENTS:

1. To identify the meters from the given lot w.r.t application.
2. To convert & calibrate a D'Arsonnal type galvanometer into a voltmeter & an ammeter.
3. To calibrate an energy meter with the help of a standard wattmeter & a stop watch
4. To measure power & p.f. in 3-phase circuit by 2-watmeter method using P. T and C.T.
5. To measure capacitance by De Sauty's bridge.
6. To measure inductance by Maxwell's bridge.
7. To measure frequency by Wien's bridge.
8. To measure magnitude & phase angle of a voltage by rectangular type potentiometer.
9. To measure magnitude & phase angle of a voltage by polar type potentiometer.
10. To measure low resistance by Kelvin's Double bridge.
11. To measure high resistance by loss of charge method.
12. To measure R,L,C, by Q metre

Note: At least seven experiments should be performed from above list. Remaining three experiments may either be performed from above list or designed & set by concerned institution as per scope of syllabus.

EE-216N	Signal and System Lab					
Lecture	**Tutorial**	**Practical**	**External**	**Sessional**	**Total**	**Exam Time**
		2	**25**	**25**	**50**	**3 Hr.**

LIST OF EXPERIMENTS:

1) To demonstrate some simple signal.

2) To explore the effect of transformation of signal parameters (amplitude-time-scaling and time-shifting).

3) To explore the various properties of the impulse signals.

4) To visualize the complex exponential signal and real sinusoids.

5) To identify a given system as linear or non-linear.

6) To explore the time variance and time invariance property of a given system.

7) To explore causality and non-causality property of a system.

8) To visualize the relationship between the continuous-time Fourier series and Fourier transform of a signal.

9) To visualize the relationship between the discrete-time Fourier series and Fourier transform of a signal.

10) To visualize the relationship between continuous-time and discrete-time Fourier transform of a signals.

11) To demonstrate the time domain sampling of band limited signals (Nyquist theorem).

12) To demonstrate the time domain sampling of non-band limited signals and anti aliasing filter.

13) To demonstrate the signal reconstruction using zero-order hold and first-order hold filters.

14) To demonstrate the sampling in frequency domain (Discrete Fourier Transform).

15) To demonstrate the spectral analysis using Discrete Fourier Transform.

17) To demonstrate the convolution and correlation of two continuous-time signals.

18) To demonstrate the convolution and correlation of two discrete-time sign

Note: At least ten experiments should be performed from above list.

EE-218N	Electrical Machine-II LAB					
Lecture	Tutorial	Practical	External	Sessional	Total	Exam Time
0	0	2	50	50	100	3 Hr.

LIST OF EXPERIMENTS:

1) To perform load test on a 3-phase induction motor & DC generator set and to determine the efficiency of induction motor.

2) Determine mechanical losses by light running of a 3-phase induction motor.

3) Study and starting of 1-phase induction motor. To perform light running and block rotor test and to determine the parameters of the equivalent circuit.

4) To perform the open circuit test and block rotor test on 3-phase induction motor and draw the circle diagram.

5) To perform & study effect of rotor resistance on a poly phase slip ring induction motor.

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6)To calculate regulation by synchronous impedance method:-

a) Conduct open and short circuit test on a three phase alternator.

b) Determine and plot variation of synchronous impedance with I_f

c) Determine SCR

d) Determine regulations for 0.8 lagging power factor, 0.8 leading power factor and unity PF.

7) To plot V curves of a synchronous machine.

a) Determination of X_o of a synchronous machine.

b) Measurement Xd&Xq (Direct axis and Quardrature axis reactance) by slip test

8) To measure Xq of synchronous machine (negative sequence reactance).

9) To calculate regulation by ZPF method.

10) To perform and study parallel operation of synchronous generators.

Note: At least ten experiments are to be performed; at least eight experiments should be performed from above list. Remaining two experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

MPC- 201NENVIRONMENTAL STUDIES

L	T	P	Sessional	Exam	Time
3	-	-	25	75	3H

UNIT I

The multidisciplinary nature of environmental studies. Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food Resources- World Food Problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem- Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem.

a. Forest Ecosystem

b. Grassland Ecosystem

c. Desert Ecosystem

d. Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/ hill/ mountain. Visit to a local polluted site- Urban /Rural/Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India.Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution: Definition, Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

UNIT IV

Social Issues and the Environment, From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management.

Resettlement and rehabilitation of people: Its problems and concerns. Case Studies. Environmental ethics-issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies.

Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations. Population explosion-Family Welfare Programme, Environment and human health, Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies.

Suggested Text Books & References:

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
3. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
4. Environmental Science- Botkin and Keller. 2012. Wiley, India.

KURUKSHETRA UNIVERSITY KURUKSHETRA

SCHEME OF STUDIES/EXAMINATIONS

Bachelor of Technology (Electrical & Electronics Engineering)

V SEMESTER (w.e.f. 2017-2018)

SN	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Duration of Exam (Hrs)
			L	T	P	Hr/ Wk	Theory	Sessional	Practical	Total	
1	EEN-301N	Power Quality & Management	3	1		4	75	25		100	3
2	EEN-303N	VLSI Design	3	1		4	75	25		100	3
3	EEN-305N	Power Electronics	4	1		5	75	25		100	3
4*	**EE-307N**	Control System	4	1		5	75	25		100	3
5*	**EE-309N**	Power Transmission & Distribution	4	1		5	75	25		100	3
6	EEN-311N	Field & Waves	4	1		5	75	25		100	3
7*	**EE-313N**	Control System Lab			2	2		40	60	100	3
8	EEN-315N	VHDL Lab			2	2		40	60	100	3
9	EEN-317N	Power Electronics Lab			2	2		40	60	100	3
10	EEN-319N	Industrial Training-I	1			1		100		100	
		Grand Total	**23**	**6**	**6**	**35**	**450**	**370**	**180**	**1000**	

Note: 1. * Subjects Common with V Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

2. **Industrial Training** undergone by the students after IV sem is to be evaluated during V sem as **(EEN-319N)** through submission of certified computerized report to the H.O.D. followed by conduct of viva-voce & seminar/presentation.

VI SEMESTER (w.e.f. 2017-2018)

SN	Course No.	Course Title	Teaching Schedule				Allotment of Marks			Marks	Dur. of Exam (Hr)
			L	T	P	Hr/ Wk	Theory	Sessional	Practical		
1	EEN-302N	Power System Engineering	4	1		5	75	25		100	3
2	EEN-304N	Data Communication & Networking	4	0		4	75	25		100	3
3	EEN-306N	Micro Processor & Micro Controller	4	1		5	75	25		100	3
4**	**EE-308N**	Electrical Machine Design	3	1		4	75	25		100	3
5**	**EE-310N**	Electric Drives & Traction	4	0		4	75	25		100	3
6	EEN-312N	Digital Signal Processing	4	1		5	75	25		100	3
7	EEN-314N	Digital Signal Processing Lab			2	2		40	60	100	3
8	EEN-316N	Micro Processor Lab			2	2		40	60	100	3
9	EEN-318N	Power System Lab			2	2		40	60	100	3
10**	**EE-320N**	Electric Drives Lab			2	2		40	60	100	3
		TOTAL	**23**	**4**	**8**	**35**	**450**	**310**	**240**	**1000**	

Note: 1. ** Subjects Common with VI Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

2. The students will have to undergo another six weeks Industrial Training after VI sem and it will be evaluated during VII sem through submission of certified computerized report to the H.O.D. followed by conduct of viva-voce & seminar/presentation.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-301N	**Power Quality & Management**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

Unit – I: Power Quality Problems & Monitoring

Overview and Definitions of power quality, sources of pollution, international power quality standards, and regulations.

Unit – II: Power Quality Problems

Surges, voltage sag and swell, over voltage under voltage, outage voltage, and phase angle imbalance, electric noise, harmonics, frequency deviation monitoring.

Unit – III: Power System Harmonics

Harmonic analysis, harmonic sources – the static converters, transformer magnetization and non-linear machines, are furnaces, fluorescent lighting. Harmonic effect within the power system, interference with communication harmonic measurements.

Unit – IV:

Design, measure to minimize the frequency and duration of outages in distribution systems voltage regulators, harmonic filters, power conditioners, uninterruptible power suppliers, emergency and stand by power systems, application of power conditioners. Power distribution systems design, measure to minimize voltage disturbances.

Text Books:

1. N. G. Hingonani, Gyugi, Understanding FACTS concepts, Technology of flexible AC Transmission systems, IEEE Press, 1999

Reference Books:

1. T.J.E Milles , Reactive Power Control in Electric Systems, John Wiley & Sons 1982.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-303N	**VLSI Design**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Introduction: Monolithic Silicon Fabrication Technology: Crystal Growth, Vapour phase (CVDT Technique) and molecular beam epitaxy. Dry and wet Etching.

UNIT II

Diffusion & Oxidation: Oxide properties, oxidation kinetics, Oxidation process, diffusion Fick's law, dopant sources, Diffusion mechanism, Constant source & limited source diffusion, Characterization of diffused layers, Introduction to ion implantation.

UNIT III

Lithography & Metallization: Choice of metals, Vacuum evaporation, Sputtering Metalization problems, Lithography: Introduction to Photo, X-ray, electron beam lithography process, various printing techniques.

UNIT IV

Planer Technology: Fabrication process, Sequence for a BJT, Capacitor, resistor, IC, Environment for IC fabrication,. Assembly & packaging techniques.

Introduction to MOS Technology: Basic MOS transistors, NMOS & CMOS fabrication.

MOS Inverters: Pass Transistor, NMOS Inverter, CMOS Inverter, Latch up in CMOS circuits.

References:

1 K.R. Botkar: Integrated Circuits.
2 S.M. Sze: Micro Electronics.
3 Milliam Grabel : Mico Electronics
4 Pucknell : VLSI Design.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-305N	**Power Electronics**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Introduction: Characteristics of SCR, Diac, Triac and UJT. Protection of SCR against-over voltage, over current, *dv/dt, di/dt*, Heat sink design, Methods of commutation of SCR's, Series and Parallel operation of Thyristors.

UNIT II

AC to DC Converters: Classification of rectifiers, principle of working of each along with control circuits, Analysis of output voltage and current waveforms. Ripple factors, utility factor and efficiency, Effect of source and load inductance, Dual converter.

UNIT III

AC to AC Converters: Classification of Cycloconverters, principle of working along with control circuits, Analysis of output voltage and current waveforms, presence of sub-harmonic in cycloconverter output.

UNIT IV

DC to AC Converters: Classification of inverters, operation of each type, Analysis of voltage and current waveforms, current source inverter, voltage source inverter and pulse width modulated inverter.

DC to DC Converters: Classification of choppers, operating principle and control circuits for each type, Analysis of voltage and current waveforms.

References:

1. Thyrister Engineering by M.S. Brede.
2. Thyrister and their Application by M. Ramamurthy.
3. Thyrister Theory and Applications by Sugandhi and Sugandhi.
4. Principles of Inverter Circuits by B.D. Bedfred and R.G. Hoft.
5. Line Commutated Thyristor Converter by Gotifriend, Moltgen.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-307N	**Control System**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Control Systems: Basics & Components: Introduction to basic terms, classifications & types of Control Systems, block diagrams & signal flow graphs, Mathematical Models of Physical System, Differential equation of physical systems & electrical systems with analogy. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula. Error detectors, Signal conditioners, Modulators, Demodulators, Servo amplifiers voltage and power, Actuators including servomotors, Techogenerators, Stepper motor.

UNIT II

Time–Domain Analysis :Time domain analysis, transient response of first & second order systems ,steady state error and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.

UNIT III

Frequency Domain Analysis and Stability : Concept of stability, graphic and numeric techniques of stability analysis, Routh Hurwitz, Nyquist, Bode plot, Root locii and polar plots, frequency domain specifications and performance of LTI systems, Gain and phase margins, relative stability. Correlation with time domain performance closed loop frequency responses from open loop response. Limitations of frequency domain analysis.

UNIT IV

State Space & Compensation Techniques: State space characteristics of control systems. Concepts of state variable, Transfer Function controllability and observability. Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation.

References :

1. Control System Engg. By Nagrath and Gopal.
2. Control System Engg. By K.Ogata.
3. Liner Control System by R.S. Chauhan, (Umesh Publications)
4. Feedback control system Analysis and Synthesis by D'Azzo and Houpias.
5. Control System by B.C. Kuo.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-309N	**Power Transmission & Distribution**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT- I

Transmission of Power by A.C. & D.C. system: Typical power system, Modern trends in power system transmission . Underground and overhead system, Effects of increase in Voltage on transmission line efficiency
Distribution of Power: General consideration, Radial and ring main system. Different types of distributors; Relative copper consumption in various systems. Conductor size and Kelvin's Law, Tariffs and power factor improvement.

UNIT- II

Resistance of transmission lines, skin effects, Proximity effect,
Inductance of a single phase & two phase line, Composite conductor lines, Three phase lines with symmetrical and unsymmetrical spacing, , Bundled conductors
Capacitance of two-wire line, three phase line with symmetrical and unsymmetrical spacing, Effect of earth capacitance.

UNIT- III

PERFORMANCE OF LINES Short, medium and long lines – their representation, Performance calculation, determination of ABCD parameters, Ferranti effect, Surge impedance Loading of transmission lines, , Calculation of synchronous phase modifier capacity.
Corona loss & radio interference Factors affecting corona , advantages and disadvantages of corona, disruptive critical voltage, visual critical voltage, corona power loss, methods of reducing corona effects, advantages & disadvantages of corona, interference of power lines with neighboring communication lines.

UNIT IV

Underground cables, Cables for A.C & D.C systems, Insulation resistance and capacitance, capacitance measurement, cable loss, Power factor in cable. Heating of cables Thermal characteristics, Use of inter sheaths, Capacitance grading.

Mechanical Considerations Types of Insulators, Methods of equalizing voltage distribution, Line supports, various types of conductor material, Sag calculations, Effect of wind, Ice and temperature on sag, Conditions at erection.
Text Books/References:

1. Power System analysis and Stability by S.S. Vadhera
2. Electrical Power System by C.L. Wadhwa
3. Electrical Power System by Ashfaq Hussain
4. Elements of Power System Analysis by W.D. Stevenson
5. Electric Power System by B.M. Weddy
6. The transmission and Distribution of Electric energy by H. Cotton
7. Modern Power System Analysis by I.J. Nagrath and D.P. Kothari
8. A Course in Electrical Power by Soni, Gupta and Bhatnagar

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-311N	**Field & Waves**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT – 1

Review of vector algebra, the three orthogonal co-ordinate systems and their inter-relation, review of vector calculus in all the three coordinate systems: Line, surface & volume integrals, gradient, divergence & curl of vector & their physical significance, Divergence theorem, stokes theorem, concept of soleniodal and irrotational fields.

Gauss Law in electrostatics & its applications, uniform line, surface & volume charge distributions, concept of electric field & electric potentials, electric field & potential due to a linear dipole, Spherical & cylindrical capacitor, energy density in electric field, method of images.

UNIT-II

Magnetostatics: Magnetic flux density and magnetizing field intensity, Biot Savart's law, Amperes circuital law & its applications. Magnetic vector potentials, Magnetic field energy, boundary conditions for both the electric & magnetic fields at the interface of various types of media. Laplace, Poisson's equation & continuity equation, displacement current density, conduction current density, Maxwell's equation in differential & integral forms, time harmonic cases & their physical significance, retarded potentials.

UNIT- III

UPW: Plane waves & uniform plane waves and their properties , wave equations in various media, Polarization & its types, intrinsic impedance, propagation constant, reflection & refraction of uniform plane waves at the interface of conductor- dielectric & dielectric-dielectric (both normal and oblique incidence). Relaxation time, skin effect, skin depth & surface impedance, Poynting vector theorem and its physical significance.

UNIT- IV

Transmission lines: Distributed parameters, circuit parameters, concepts of voltage & current flow on a transmission line, line equations, characteristics impedance. Reflection of transmission line, maxima & minima, standing wave ratio of a transmission line, impedance matching, Smith's chart & its applications, co-axial type transmission line.

Wave Guides: Brief idea of Wave Guides, types of Wave Guides. TE, TM and TEM modes in rectangular wave guides.

Reference Books:

1. Field & Waves Electromagnetic by D.K. Cheng. (Pearson Education)
2. Electromagnetic Fields & Wave by Sadiku (Oxford Univ. Press)
3. Electromagnetic by J.D. Kraus, MGH.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EE-313N	**Control System Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS:

1. Experiment to study linear system simulator.
2. To study the stroboscope & measure the shaft speed
2. Experiment to study light intensity control using P & PI controller with provision for and transient speed control.
3. Experiment to study D.C motor speed control.
4. Experiment to study the stepper motor characteristics and its control through microprocessor kit.
5. Experiment to study Temperature control system.
6. Experiment to study Compensation design.
7. Experiment to study Digital control system.
8. Experiment to study synchros.
10. Experiment to study AC Position control system.
11. Experiment to study Potential Metric Error detector.

NOTE: 10 experiments are to be performed with at least 8 from above list; the remaining may either be performed or designed & set by concerned Institution as per the scope.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EEN-315N	**VHDL Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS

1. Study of VHDL.
2. To design the two input NAND gate , NOR gate , EX-OR gate in VHDL .
3. To design a full adder & full subtractor using the same hardware & with the help of control signal.
4. To design a 4:1 multiplexer and 1:4 demultiplexer in VHDL.
5. To design a priority encoder in VHDL
6. To design a carry look ahead adder in VHDL.
7. To design a BCD adder & BCD subtractor in VHDL.
8. Write a program in VHDL to compute 2's complement of a four bit binary numbers.
9. Write a program in VHDL to implement the Boolean expression . F= (A+ B) (C+D) using CMOS circuitry .
10. Implement a F= (A+ B) using only PMOS circuitry.
    (i) Design a MOD-6 synchronous & asynchronous (ripple) counter in VHDL.
    (ii) Design a MOD-8 ring & Johnson counter in VHDL.
11. How to Install the VHDL on Computers for VLSI programs

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EEN-317N	**Power Electronics Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS

1. To plot the firing characteristics of given silicon control rectifier.
   (A) By varying the gate current I_g keeping forward voltage V_{ak} fixed.
   (B) By varying forward voltage V_{ak} keeping gate current fixed
2. To study the V-I characteristics of given UJT (2n2646)
   To plot graph between V_e and I_e to find negative resistance region from the graph.
3. To plot V-I characteristics of given Triac in I and III quadrant.
4. To plot the drain characteristics of given FET & to evaluate the parameter RD, IDSS.
5. To study the UJT based relaxation Oscillator and to evaluate the dynamic resistance.
6. To study and draw the characteristics of DC-DC Chopper power circuit.
7. To study the characteristics of Single Phase fully controlled converter circuit.
8. To study the characteristics of 3-Phase Fully controlled power circuit.
9. To study Single Phase Cycloconverter circuit.
10. To study 3-Phase half wave rectifier using MAT LAB.

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-302N	**Power System Engineering**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Introduction: Characteristics & representation of components of a power system, synchronous machines, transformers, lines cables & loads. Single line diagram.

Protective Relaying: Scheme of protection of generators, transformers, transmission lines & bus-bars, carrier current protection.

UNIT II

Circuit Interruption : Circuit interruption, theory of arc formation and it's excitation in d.c., a.c. circuits, restriking & recovery voltage, interruption of capacitive & inductive currents. Rupturing capacity & rating of circuit breakers.

Circuit-Breakers : Classification of circuit-breakers, circuit-breakers of low medium, high & extra high voltages. Multibreak & resistance switching. H.V. circuit breakers.

UNIT III

Fault Analysis:-

Symmetrical faults: Calculation of fault currents, use of current limiting reactors.

Unsymmetrical faults: Types of transformation in power system analysis, symmetrical components transformation.

Grounding: Need of neutral grounding, various types of neutral grounding technique, equipment earthing for safety.

UNIT IV

Transients in Power Systems: Transient electric phenomenon, travelling waves, reflection & refraction of waves with different line termination.

Stability of power System: Concepts of stability, power angle characteristics of Synchronous, steady state & transient stability swing waves.

References:

1. Elements of power system analysis by W.D. Stevenson.
2. Electric Power System by B.M. Weddy.
3. The transmission & Distribution of Electric Energy by H.Cotton.
4. Modern Power System Analysis by I.J. Nagrath & D.P. Kothari.
5. A course in Electrical Power by Soni, Gupta & Bhatnagar.
6. Power System Analysis & Stability by S.S. Vadhera
7. Electrical Power System by C.L. Wadhwa. 8. Electrical Power System by Ashfag Hussain.
9. Electrical Power by S.L. Uppal.
10. Switching & Protection by Sunil S. Rao.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EX-304N	**Data Communication & Networking**	**4**	**0**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I: Basic & Computer Networks, Need & Evolution of Computer Networks, Description of LAN, MAN, WAN and wireless Networks, OSI and TCP/IP models with description of Data Encapsulation & peer to peer communication, Comparison of OSI and TCP/IP, Basic terminology of computer networks- bandwidth, Physical and logical topologies, LAN & WAN devices- Router, bridge Ethernet switch HUB, Modem CSU/DSU etc.

UNIT II: Physical Layer- Representation, Optical Network and wireless N/W, Encoding/Modulation- TTL Encoding, Manchester Encoding, AM, FM and PM, Dispersion, Jitter, Latency and collision. Different types of Media- Shielded twisted pair, Unshielded twisted pair, Coaxial cable, Optical Fiber cable and wireless. Layer- LLC and MAC sub layer, MAC addressing Layer 2 devices, Framing Error control and flow control. Error detection and correction CRC Codes, block parity and Checksum, elementary data link protocol, sliding window protocol, Channel allocation problem- static and dynamic.

UNIT III: Multiple Alex protocol- ALOHA, CSMA/CU Token bus Tokening, FDDI.Network Layer, Segmentation and autonomous system path determination, Network Layer addressing, Network-layer data gram, IP addressed classes, Subneting,Sub network, Subnet mark, Routing algorithm- optimality Principle, Shortest path routing , Hierarchical routing, Broadcast routing, Multicast routing.

UNIT IV: Transport Layer- Layer 4 Protocol TCP & UDP Three way hand shakes open connection ATM AAL Layer protocol, Session Layer design issue, Presentation Layer design issue and Application layer design issue. Application layer Protocol, TELNET, FTP, HTTP, SNMP.

References:

1. Tannenbum, " Computer Networks," PHI
2. Darlx, " Computer Networks and Their Protocols", DLA Labs
3. Freer, " Comp. Communication & Networks" , East-West-Pre
4. Frozen, "Data Communication & Networking (TMH)
5. Stalling ,"Data & Computer Communication.(PHI)

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EX-306N	**Microprocessor & Micro Controller**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Introduction to microprocessor, **architecture** of 8085, description of 8085 pins, flags, registers, Demultiplexing the bus $AD_7 – AD_0$, instruction cycle, machine cycle,T-state, fetch cycle and execute cycle ; timing diagram; addressing mode; interrupts

UNIT II

Instruction set: Data transfer group instruction, arithmetic group, logical group, machine group,

branch group instructions, stack operation; sub routine.

Data Transfer Techniques: Memory mapped I/O & input/output mapped I/O space, program data transfer techniques, interrupt data transfer techniques, DMA.

UNIT III

Assembly language programming & interfacing : introduction of machine language; assembly language, high lavel language, example of assembly language programming; interfacing of the memory (RAM, ROM, EPROM, EEPROM) , input device and output device;

Special purpose support devices: : Brief description of 8255 PPI , 8253, 8251 USART

UNIT IV

Advanced 8086 microprocessor & microcontroller: 8086 microprocessor, its architecture, operating mode, pin description for minimum mode, pin description for maximum mode, comparison of 8086 & 8085.

Microcontroller: introduction of 8051 microcontroller & its block diagram, comparison of microprocessor and microcontroller

References:

1. R.S. GAONKAR: Microprocessor architecture, programming & Application.(MGH)
2. Malvino, A.P. : Digital computer electronics-an Introduction to microprocessor.(MGH)
3. D.V.HALL: Microprocessor & Digital circuits.(MGH)
4. MATHUR A.P. : Introduction to microprocessor

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-308N	**Electrical Machines Design**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

GENERAL: General features , limitations of electrical machine design, specific loadings **thermal design** types of enclosures, ventilation, heat dissipation, temperature rise, heating & cooling cycles, rating of machines, cooling media used, advantages of hydrogen cooling, effect of size and ventilation.

DC MACHINES: Main parts ,Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core ,air gap length, cross section of armature conductors, armature slots ,**design of field system** field poles, field coils, commutater.

UNIT II

TRANSFORMERS: Main parts of transformer, Standard specifications, output equation, voltage per turn , optimum design, design of core , design of winding, simplified steps for transformer design, tank and Cooling tubes, **Operating calculations** circuit parameters, magnetizing current, losses and efficiency, Temperature rise and regulations from design data.

SYNCHRONOUS MACHINES: Types of construction, types of synchronous alternators Specifications, output equation , **design of salient pole machines** main dimensions, short circuit ratio , length of air gap, choice of armature slots, turns per phase, conductor section , **design difference between turbo alternator & salient pole generators**, , direct & indirect cooling.

UNIT III

INDUCTION MOTORS:
Three Phase Induction Motor: Standard specifications, output equations, choice of specific loadings, main dimensions, conductor size and turns, no. of slots, slot design, stator core depth, **rotor design**, rotor bars& slots area, end rings .
SINGLE PHASE INDUCTION MOTOR: output equations, specific loadings, main dimensions, design of main and auxiliary winding, capacitor design, equivalent circuit parameters, torque, efficiency.

UNIT IV

COMPUTER AIDED DESIGN: Computerization of design procedures, development of computer programs & performance predictions, optimization techniques & their application to design problems.

TEXT BOOKS/REFERENCES:

1. Electrical Machine Design by A. K. Sawhney Dhanpat Rai & co.
2. M.G.Say, Performance and design of ac machines, CBS Publishers.
3. S.K. Sen., Principles of Electrical Machine Design with Computer Programs, Oxford and IBH.
4. A.E.Clayton, Hencock: Performance and design of dc machines, CBS Publishers.
5. J.H. Kuhlmann, Design of electrical operators, John Willey, 1957 .
6. CG Veinott, Theory and design of small induction machines, MGH, 1959
7. A Shanmugasundarem, Electrical machine design databook, John willey, 1979

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-310N	**Electric Drives & Traction**	**4**	**0**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT-I

Introduction: Definition & classification of different type of electric drives, its Review characteristics, choice of electric drive ,components of electric drives, advantages and applications.

Dynamics of Electric drives & Rating of motors: - Fundamental load torque equation, types of loads, frequency operation of motor subjected to intermittent loads, pulse loads etc. Determination of motor rating, Heating/cooling curve, Nature of loads and classes of motor duty.

Control of Electrical Drives: Modes of operation, closed loop control of drives, sensing of current and speed**.**

UNIT-II

D.C. drives: Various methods of braking of D.C. drives, Speed control methods of D.C. drives, 1-∅ fully controlled and half controlled rectifier fed separately excited D.C. motor, 3-∅ fully and half controlled fed separately excited D.C. Motor, Performance and characteristics of 1-∅ and 3-∅ rectifier controlled D.C. drives.

UNIT-III

AC Drives: Various methods of braking of A.C. drives, Speed control methods of A.C. drives, Basic principle of induction motor drives, 3 -∅ A.C. Voltage controller fed I.M drive, Drives using chopper, multi quadrant control of chopper fed motors, Synchronous motor Drives, Automatic starting and pulling operation of synchronous motors

UNIT-IV

Traction Drives: Nature of traction load, A.C. & D.C. motor drives in transportation system and traction & its characteristics, Duty cycle & speed time relationship, Polyphase A.C. motors for traction drives, D.C. traction using chopper controlled D.C. motors.

TEXT BOOKS:

1. Fundamentals of Electrical Drives, G.K.Dubey, Narosa Publishing House

REFERENCE BOOKS:

1. Power Semiconductor controlled drives, G.K.Dubey, Prentice Hall.
2. Electric Drives: V.Subrahmaniyam TMH
3. Electric Drives: Leonard, Narosa Pub.
4. Electric Drives: Diwan
5. Power Electonics : M.D.Singh, K.B.Knanchandani : Mc Graw Hill
6. Electric Motor Drives by Krishnan,PHI
7. Electric Drives: S.K.Pillai,New Age

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-312N	**Digital Signal Processing**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections.

UNIT I

Introduction: Basic elements of DSP system, Advantages and disadvantage of DSP over analog processing, Application of Digital signal processing.

Z-Transform: Direct Z-Transform and importance of ROC, properties of Z-Transform, Inverse Z-transform methods, Rational Z-transform function representation, system function of LTI systems in Z-domain, one sided Z –Transform. Solution of difference equations. Analysis of LTI system in Z- domain, transient and steady- state response. Causality and stability. Pole- Zero Cancellations.

UNIT II

FREQUENCY TRANSFORMATIONS

Introduction to DFT, Direct Computation of DFT ,Properties of DFT, Circular Convolution , Fast fourier Transform(FFT),decimation in time ,decimation in frequency algorithm, Use of FFT in Linear Filtering , Goetzel Algorithm, Chirp-Z Transform algorithm.

UNIT III

Structure of Discrete-Time Systems: Structure for FIR Systems-direct form, Linear Phase, Cascade form, Frequency-Sampling structures, Structures for IIR- Direct, Cascade, Parallel & transposed structure, signal flow graphs .

Design for Digital Filters:- Symmetric and anti-symmetric FIR filters; Design of Linear Phase FIR using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency Sampling Method of FIR design, Impulse Invariance transformation, Bilinear transformation and its use in design of Butterworth and Chebyshev IIR Filters; Frequency transformation in Digital Domain, Matched Z-Transformation.

UNIT IV

Implementation of Discrete Time Systems:
Lattice, Ladder and Lattice-Ladder Structures, Shur- Cohn Stability test. Jury Test, Shur-Cohn-fuzzivera stability criterion for IIR filters, Discrete Hilbert Transform.
DSP processor architecture fundamentals: Study of ADSP and TMS series of processor architectures.

References:

1. Digital Signal Processing by J.G. Proakis and D.G. Manalakis-PHI
2. Digital Signal Processing by: A.V. Oppenheim and R.W. Schafer-PHI
3. Element of Digital Signal Processing by N. Sarkar Khanna Publishers.
4. Digital Signal Processing by S. K. Mitra –TMH.
5. Digital Signal Processing by Rabinar, Gold-PHI
6. Digital Signal Processing by S. Salivahanan- TMH
7. Digital Signal Processing by IFecher

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EEN-314N	**Digital Signal Processing Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS / PROGRAMS:

1. Write a program in MATLAB to study the basic operation on the discrete time signals. (Amplitude and time manipulation).
2. Write a MATLAB program to perform discrete convolution (linear and circular) for a given two sequences.
3. Write a MATLAB program to perform the DFT for a given sequence.
4. Write a MATLAB program to compute DFT and IDFT for a given sequence using FFT algorithem.
5. Write a MATLAB program to perform sampling rate conversion for any given arbitrary sequence by interpolation, decimation, upsampling, downsampling and resampling.
6. Write a MATLAB program to find the time domain response (Impulse response and phase response) for a given FIR and IIR systems.
7. Write a MATLAB program to find the frequency domain response (magnitude response and phase response) for a given FIR and IIR systems.
8. Write a MATLAB program to design a low pass filler using window method for the given specification.
9. Write a MATLAB program to design Butterworth and Chebyshev low pass filler using bilinear transformation and Impulse Invariant Transformation.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EEN-316N	**Microprocessor Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS:

1 To study the 8085-microprocessor kit.

2 Add two Binary numbers using 8085-Microprocessor kit.

3 Find 2's complement of a binary number using 8085-Microprocessor kit.

4 To arrange a series of numbers in descending order using 8085- Microprocessor kit.

5 Multiplication of two binary numbers using 8085-Microprocessor kit.

6 Divide a 16-bit number by 8-bit number and restore result in memory location 2700 using 8085-Microprocessor kit.

7 To find Square root of a 8- bit number using 8085-Microprocessor kit .

8 To find the largest number in a data array using 8085-Microprocessor kit.

9 To interface a D/A converter with the 8085-microprocessor kit.

10 To interface the stepper motor with the 8085-microprocessor kit.

Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EEN-318N	**Power System Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS:

1. To find out the dielectric strength of transformer oil.
2. To find zero sequence component of three phase line.
3. To draw the characteristics of thermal overload relay.
4. To study an IDMT over current relay to obtain and plot its characteristic curves i.e. the graph between current and time.
5. To measure the ABCD parameters of a given transmission line.
6. To plot the power angle characteristics of given transmission lines.
7. To find the string efficiency of a string insulator with/without guard rings.
8. To study the characteristics of transmission line for t-network & pie- network.
9. To study and testing of a current transformer.
10. To study various types of distance relays.

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Code	Nomenclature of Lab	P	Int.	Ext.	Total	Time
EE-320N	**Electric Drives Lab**	**2**	**40**	**60**	**100**	**3 Hr**

LIST OF EXPERIMENTS-

1. Study of Industrial Applications of various mills.
2. Variable Torque Control of Induction Motor.
3. Breaking of DC Motor by using Mechanical & Electrical Methods.
4. Rotor resistance control of 3 phases Slip Ring Induction Motor.
5. Chopper Control of DC Motor.
6. Chopper Control of separately excited DC motor.
7. Study of different types of a loading on a particular load.
   (a) Intermediate Loading
   (b) Continuous Loading
8. Methods of starting Induction Motor.
9. Variable Voltage Control of Induction Motor.
10. Microprocessor Based Control of any Motor.
11. To study direct torque control of DC motor in MATLAB.

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution.

6KURUKSHETRA UNIVERSITY KURUKSHETRA
SCHEME OF STUDIES/EXAMINATIONS
Bachelor of Technology (Electrical & Electronics Engineering)
VII SEMESTER (w.e.f. 2018-2019)

S. No.	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Duration of Exam
			L	T	P	Hr/ Wk	Theory	Sessional	Practical	Total	(Hrs)
1	**EE-401N***	**Utilization of Electrical Energy**	3	1		4	75	25		100	3
2	EEN-403N	Electronic Instruments and Measurements	3	1		4	75	25		100	3
3	EEN-405N	Advance Programming	3	1		4	75	25		100	3
4	**	Elective - I	3	1		4	75	25		100	3
5	**	Elective - II	3	1		4	75	25		100	3
6	EEN-407N	Electronic Instruments and Measurements Lab			2	2		40	60	100	3
7	EEN-409N	Advanced Programming Lab			2	2		40	60	100	3
8	EEN-411N	Minor Project			3	3		75	75	150	3
9	EEN-413N	Industrial Training-II			2	2		100		100	3
		Grand Total	17	5	9	29	375	380	195	950	

Elective - I		**Elective - II**	
EEN-415N	HVDC Transmission	EEN-421N	Non-Conventional Energy Sources
EEN-417N	Microwave and Radar	EEN-423N	Operating System
EEN-419N	Antenna & Wave Propagation	EEN-425N	Power System Planning

Note: 1. * Subject Common with VII Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.
2. The Minor Project should be initiated by the student in the VII th semester beginning and will be evaluated in the end of the semester on the basis of a presentation and report submitted to the department.

3. **Industrial Training-II** undergone by the students after VI sem is to be evaluated during VII sem as **(EEN-413N)** through submission of certified computerized report to the H.O.D. followed by conduct of viva-voce & seminar/presentation.

VIII SEMESTER (w.e.f. 2018-2019)

S. No.	Course No.	Course Title	Teaching Schedule				Allotment of Marks			Total	Dur. of Exam (Hr)
			L	T	P	Hr/ Wk	Theory	Sessional	Pract.		
1	EEN-402N	Modern Trends in Communication	3	1		4	75	25		100	3
2	EEN-404N	Modeling and Simulation	3	1		4	75	25		100	3
3	**EE-406N***	**Special Electrical Machines**	3	1		4	75	25		100	3
4		Elective - III**	3	1		4	75	25		100	3
5		Elective - IV**	3	1		4	75	25		100	3
6	EEN-408N***	Major Project			3	3		75	75	150	3
7	EEN-410N	Simulation Lab			2	2		40	60	100	3
8	EEN-412N	Electronic Design Lab			2	2		40	60	100	3
9	EEN-414N****	General Fitness & Professional Aptitude							100	100	
		TOTAL	15	5	7	27	375	280	295	950	

Note: 1. * Subjects Common with VIII Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

2. ** The students should opt two departmental electives subjects from the list of core elective subjects.
3. ***The Major project should be initiated by the student in continuation of the VII semester and will be evaluated in the end of the semester on the basis of a presentation and Report.
4. **** A viva of the students will be taken by external examiner (Principal/Director/Professor/or any senior Person with Experience more than 10 years) at the end of the semester.

Elective - III		Elective - IV	
EEN-420N	Computer Architecture and Organization	EEN-426N	Digital Image Processing
EEN-422N	Radio & TV Engineering	EEN-428N	Software Engineering
EEN-424N	Advanced Microprocessor and Interfacing	EEN-430N	Fuzzy logic & Neural Networks

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-401N	**Utilization of Electrical Energy**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Illumination: Term used in illumination, Law's of illumination, sources of light, arc lamp incandescent lamp, discharge lamp, sodium vapor, mercury vapor lamp, florescent tubes, lightening schemes, method of lightning calculation.

UNIT II

Electrical Heating: Advantages of Electrical Heating, various types of Electrical heating, Power frequency and High frequency heating, Degree of heating element, Equivalent circuit of arc furnace, Resistance heating, Arc heating, Induction heating, dielectric heating etc.

Electric Welding: All types of electrical welding, resistance welding, arc welding, electrical winding equipment, Comparison between AC & DC welding, types of electrodes, advantages of coated electrodes.

UNIT III

Electroplating: Basic principle, faraday's law of electrostatics, terms used, Application of electrolysis, factors governing electro deposition, power supply.

Refrigeration & Air Conditioning: Basic principle, various compression cycle & system its application, electric circuit of refrigerator, air conditioner.

UNIT IV

Traction Motors: Different system of electric traction, comparison between AC & DC system, block diagram of traction system ,Starting-Speed control and braking- Speed control and braking –Speed time curves,-Mechanics of Train movement-Tractive effort for acceleration – Power and energy output from driving axles-Specific energy output and consumption-Train resistance.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Dr.S.L.Uppal, Electrical Power, Khanna Publishers, New Delhi
2. M.L.Soni,P.V.Gupta,U.S.Bhatnagar,A.Chakrabarti,"A TextBook On Power System Engineering", Dhanpat Rai & Co,New Delhi
3. H.Pratap, Art and Science of Utilization of Electric Energy, Dhanpat Rai & Sons, New Delhi
4. G.C.Garg, Utilization of Electric Power and Electric Traction, Khanna publishers, New Delhi

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time

EEN-403N	**Electronic Instruments and Measurements**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

C.R.O.: Introduction, Cathode Ray Tube (CRT), Electron Gun, Electrostatic Focusing, Electrostatic Deflection, Post Deflection Acceleration of Electron Beam, Effect of Beam Transit Time, Frequency limitation. Deflection plates, Screens of CRT's Graticule Aquadog, Applications, Storage C.R.O. Digital CRO. Design of delay lines for CRO.

Amplifier Measurement: Amplifier Measurements, Transient response of Amplifiers, Measurements of Noise figure of Amplifier, Harmonic Distortions analyzer, Distortion Meter, Measurement of op- amp parameters.

UNIT II

Digital Instruments: Digital Indicating instruments, comparison with analog type digital display methods, theory and applications of digital voltmeters. Transistor, FET and other type of voltmeters. Electronic Galvanometers, Q-meter.

Frequency Measurements: - Measurements of frequency use cavity wave-meter. Heterodyne frequency meter, comparison of frequency using interpolation method. Digital frequency meter. Frequency measurements using digital means.

UNIT III

Signal Conditioning & Acquisition System: Signal conditioning, A/D converter, D/A Converter, Use of op-amp in signal conditioning, Components of analog data acquisition System. Components of digital data acquisition system, signal conditioning, multiplex special Encoders, Principles of Telemetry, Wire link channels, Ratio channels, and Microwaves Channels.

UNIT IV

Instruments For Signals Generation: Pulse and square wave circuits, Laboratory square wave and pulse generators, Function generators, Random noise generators, Frequency Synthesizer.

Bio-Medical Instruments:- ECG, EEG, EMG & Measurement of BP.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all , selecting at least one question from each unit..

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References:

1. A course in Electrical & Electronics Measurement & Instrumentation: By A.K. Sawhney.
2. Electronics Instruments & Measurements techniques: By Helffrick & Cooper (PHI)
3. Instrumentation devices & Systems: By C.S. Rangan, G.R. Sharma & V.S. Mani.
4. Bio- medical Instrumentation & measurements: By Leslie Cromwell, Fred. J. Weibell, Erich A. Pfeitter (PHI).

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time

EEN-405N	Advance Programming	3	1	25	75	100	3 Hr

UNIT I

Review of Elementary Data Structures: arrays, stacks, queues, link list with respect to storage representation and access methods.

UNIT II

Searching Methods: Sequential, binary, Indexes searches**.**

UNIT III

Sorting: internal and external sorting, Methods: bubble, insertion, selection, merge, heap, radix and quick sort. Comparison with respect to their efficiency.

UNIT IV

C++ Programming Language: Concept of object oriented programming, Abstract Data type C classes, Data encapsulation, inheritance, polymorphism, virtual function templates implementation using C++.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Trembley and Sorenson, "An Introduction of data structures with application" McGraw Hill.
2. Goodman, S.E., and Hetedniemi, S.T, "Introduction to the design and Analysis" , McGraw Hill.
3. Herbert Schildt, "C++ Computer reference", TMH.
4. Herowitz E and Sahni S. "Fundamentals of Data Structures".

Code	Nomenclature of Subject	P	Int	Ext.	Total	Time
EEN-407N	**Electronic Instruments and Measurements Lab**	**2**	**40**	**60**	**100**	**3Hr**

List of Experiments:

1. To measure the unknown Inductance in terms of capacitance and resistance by using Maxwell's Inductance bridge.
2. To measure unknown Inductance using Hay's bridge.
3. To measure unknown capacitance of small capacitors by using Schering's bridge.
4. To measure 3-phase power with 2-Wattmeter method for balanced and unbalanced bridge.
5. To measure unknown capacitance using De-Sauty's bridge.
6. To measure unknown frequency using Wein's frequency bridge.
7. To measure unknown low resistance by Kelvin's Double bridge.
8. To test the soil resistance using Meggar (Ohm meter).
9. To calibrate Energy meter using standard Energy meter.
10. To plot the B-H curve of different magnetic materials.
11. To calibrate the Voltmeter using Crompton Potentiometer.
12. To convert the Voltmeter into Ammeter using Potentiometer.
13. Insulation testing of cables using Digital Insulation Tester.

NOTE: At least 9 experiments are to be performed with 8 from above list, remaining may either be performed or designed & set by concerned institution as per the scope.

Code	Nomenclature of Subject	P	Int	Ext.	Total	Time
EEN-409N	**Advance programming lab**	**2**	**40**	**60**	**100**	**3Hr**

List of Experiments:

Write a program to perform following operations on linked list.

1. Insertion of a node
2. Deletion of node.
3. WAP to implement stack.
4. WAP to implement queues.
5. WAP to sort a list using following.
6. Insertion sort and. Quick sort
7. Bubble sort and Merge sort
8. Selection Sort and Radix sort
9. WAP to find roots of quadratic equation using polymorphism.
10. WAP to find addition & multiplication of two matrices using classes.
11. WAP which shows the use of inheritance.
12. WAP to implement the concept of copy constructor & destructor.

NOTE: At least 9 experiments are to be performed with 8 from above list, remaining may either be performed or designed & set by concerned institution as per the scope.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-402N	**Modern Trends in Communication**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Digital Communication: Introduction to sampling theorem for band limited & band pass signals, bit rate, detection levels, Digital filtering, Pulse code modulation, Adaptive data modulation, coding, Coding efficiency, introduction to used codes. Error detection & corrections codes, ASK,FSK, PSK,DPSK,QPSK.

UNIT II

Satellite Communication: Introduction, Satellite orbits, frequency used, station keeping, orientation of satellite, transmission paths & its losses & noise consideration. Satellite systems flux density, effective isotropic radiated power, link budget calculations, multiple accessing techniques.

UNIT III

Fiber Optic Communication: Introduction, advantages & disadvantages, principle of light transmission in a fiber, types of optical fibers, effect of index profile on propagation, modes of propagation. Number of modes via fiber, single mode propagation, Rayleigh scattering losses, absorption losses, mode coupling losses, bending losses, combined losses, effect of dispersion on pulse transmission, inter model dispersion, material dispersion, wave guide dispersion, total dispersion.

UNIT IV

Optical Communication: LEDs, semiconductor laser diode, the PN photodiode, PIN diode. The avalanche photo diode, fiber optic communication system block diagram & loss budget, connectors & Splices.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Dennis Roddy & John Collen: Electronics Communication.(PHI)
2. John Gowar: Optical communication system (PHI)
3. D. C. Aggarwal : Satellite Communication

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-404N	**Modelling and Simulation**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT 1

Introduction: Systems, Models and simulation, concept of model, model classification and mathematical representation, Identification, continuous and discrete, static and dynamic, deterministic and stochastic systems.

UNIT 2

Discrete event systems: Introduction, statistical model in simulation, random number generation, method of generating random variables, discrete random variates, generating correlated random numbers.
Queuing models: Characteristics, queuing notation, single server and multiple server systems.

UNIT 3

Simulation: State space simulation techniques, Digital simulation languages, Analog simulation of linear systems, magnitude scaling, time scaling, simulation equations, transfer function simulator, hybrid simulation. Load flow, short circuit and steady state stability studies. Transmission parameters.

UNIT 4

Matlab: Matlab environment, programming, modeling, with matrices, simulation in Matlab, introduction to dynamic system simulation using SIMULINK, applications of simulink.
Note: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Banks J. Carson J.S and Nelson B: Discrete Event system simulation, PHI.
2. Celler F.E. Continuous system simulation, Springer verilag.
3. Athanasios Papoulis: Probability Random variables and Statistics Processes, Mc-Graw Hill.
4. Reference manual & user's guide on Matlab.
5. Analog computation & simulation (V Raja Raman)
6. System simulation with digital computer (D E O)
7. System simulation (Jorden).
8. System modeling & Computer Simulation by Nain A. Kheir. Marcel Dekker Inc.
9. Discrete Event System Simulation, PHI Banks J. Carson J. S. and Nelson B.
10. Advanced Computer methods for power system Analysis- Stagg and Elabiad.
11. Advanced power System L.P.Singh(New Age Publication.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-406N*	**Special Electrical Machines**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Different types of FHP motors and uses in domestic & industrial applications, Single phase Induction motor, Qualitative examination starting and running performance of I-Phase Induction Motors.

UNIT II

Linear Induction Motors and Actuators and its principle of operation, Linear Levitated machine & applications, Permanent magnet motors, High performance energy efficient machines, Effect of E.M.F injected into secondary circuits , quantitative study, discharge motor.

UNIT III

Special Induction generations, Special motors and generators associated with Wind, Solar, Tidal, Biogas and other unconventional energy forms and their applications.

UNIT IV

Synchronous motors, Series universal motors, Stepper motor, Permanent magnet D.C. motor, Permanent magnet AC motors, Switch reluctance motors. Servo motor, shaded pole motor, brush less D.C motor, Typical applications in Computers, Electronics, Communications and Information Technologies.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Generalized Electrical Machines by P. S. Bhimbra
2. Generations of Electrical Energy by A. E. Fitzgerald/Charles, Kingsley J. R.
3. The Performance &design of A.C Commutator Motor by O.E .Taylor
4. Performance & Design of A.C machines by M.G. Say.

Code	Nomenclature of Subject	P	Int	Ext.	Total	Time
EEN-410N	**Simulation Lab**	**2**	**40**	**60**	**100**	**3Hr**

Perform the experiments using C/C++/Matlab Language

List of Experiments:

To develop a Program for Matrix n*n.

1. Add two Matrixes.

2. Multiplication of two Matrixes.
3. Find Inverse of Matrix.
4. Check stability by Routh Hurwitz Criteria.
5. Check stability by Jury Test.
6. Draw a circle for given radius use graphics.
7. Draw a straight-line use graphics.
8. Find Eigen value for given Matrix.
9. To develop a program for Cramer's Rule
10. To develop a program for Tower of Hanoi.

NOTE: At least 7 experiments are to be performed with 6 from above list, remaining may either be performed or designed & set by concerned institution as per the scope.

Code	Nomenclature of Subject	P	Int	Ext.	Total	Time
EEN-412N	**Electronic Design Lab**	**2**	**40**	**60**	**100**	**3Hr**

List of Experiments:

1. Design a single stage R C Coupled amplifier and plot its gain frequency response.
2. Design a two stage R C Coupled amplifier and plot its gain frequency response.
3. Design a R C Phase shift oscillator using IC 741.
4. Design a Wein bridge oscillator.
5. Design a square wave generator using IC 555.
6. Design a 4: 1 multiplexer and 1: 4 Demultiplexer using logic gates.

7. Design a parallel parity bit generator using ICs.
8. Design a digital to analog converter using ICs.
9. Design a digital frequency meter (0-999HZ) using IC 555 for Monoshot, IC-7404,7408,7490,7447.
10. Design a controller such that LEDs glow in pairs sequentially using IC 7490 and LEDs.

NOTE: At least 10 experiments are to be performed with at least 7 from above list, remaining 3 may either be performed from the above list or designed & set by concerned institution as per the scope of the syllabus.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-415N	**HVDC Transmission**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Merits and Demerits of HVDC over EHVAC, type of HVDC links, Analysis Of 3- phase bridge converter with grid control for U 60 and U 60, derivation of equivalent circuit of HVDC link.

UNIT II

Basic means of control of HVDC link, C.C.A., C.C. and C.E.A, Control Characteristics of a converter, Harmonics in HVDC Operation, types of filters used for harmonic elimination, characteristics harmonics, characteristic AC current harmonics, Non characteristics AC harmonics, harmful effects.

UNIT III

Protection aspects of a HVDC link, types of faults, over current protection, over voltage protection, ground and short circuit fault & their protection.

UNIT IV

Parallel operation of A.C. and D.C. Systems. Corona & R.I characteristics of HVDC link.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. K.P. Padyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd.
2. E.W. Kimbark, "Direct Current Transmission", Vol.I, Wiley Intersect
3. J. Arrillage, "High Voltage Direct Current Transmission", Peter Peregrines
4. S. Rao," EHV-AC and HVDC transmission Engineering Practice", Khanna publishers

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-417N	**Microwave and Radar**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Introduction to microwaves and tubes, Microwave Devices: Advantage of Microwaves, limitation of conventional tubes, Light house tube, Multicavity & Reflex klystron, Magnetron

UNIT II

Tunnel diode, Gunn diode, Parametric amplifier, Masers, TWT, IMPATT, TRAPTT, Microwave solid state devices.

UNIT III

Microwave Circuits: Scattering matrix, impedance transformation & Matching, passive Microwave devices (E-plane &H-plane Tee, Magic Tee, Circulator, Attenuator, isolators, directional coupler, TE, TM & TEM modes in Rectangular wave guides, resonators, phase shifter).

UNIT IV

Radar Engg.: Introduction, Radar range equation, parameters affecting the range, Doppler effect, CW and pulse Doppler Radar, MTI delay lines and canceller, range gate pulse, MTI & Doppler radar, non coherent MTI. Noise and clutter, Radar displays, Radar signal processing, applications of radar, radio aids to navigation.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Liao S.Y.: Microwave Circuit & Devices, PHI.
2. Skolnik M. K.: Introduction to Radar system, McGraw Hill.
3. Siegman A.E. : An introduction to lasers & Masers, McGraw Hill.
4. M. Kulkarni: Microwave & Radar Engineering, Umesh Publication.
5. Gautam A. K. : Microwave Engineering , S.K. Kataria & Sons.

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Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-419N	**Antenna & Wave Propagation**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Basic Principle: Scalar & vector potential for electric & magnetic components, Retardation, retarded vector potential relation between scalar & vector potential current element.

Basic Antennas: Half wave dipole, quarter wave mono pole, short dipole, calculation of radiation resistance, effective length & pointing vector. Current distribution: Linear current & sinusoidal distribution.

UNIT II

Antenna Parameter: Solid angle, radiation intensity, directive gain directivity, power gain, beam width: HPBW, FNBW, band width, Q factor resonance in antenna, antenna as a transmission line, antenna as

active component, antenna temp. Radiation pattern, Eplane H plane, efficiency. Effective aperture, scattering aperture, loss aperture, directivity, polarization. Transmission between two Antenna, Reciprocity theorem application of Reciprocity theorem.
Low Freq Antennas: Monopole, folded, loop antenna, biconical antenna, yagi-uda antenna: different antenna used for A.M & FM transmission. VHF & LHF antennas, Resonant Antennas & non-resonant antenna, design parameter of different Antenna.

UNIT III

Microwave Antenna: Parabolic Antenna, Lens Antenna, horn Antenna, Antenna used for tracking & antenna used for satellite communication. E-plane horn, H-Plane horn circulars Horn, pyramidal Horn.
Radio Wave Propagation: Different technique for radio wave propagation: Ground wave propagation, space wave, sky wave, duct propagation, troposcatter.

UNIT IV

Ionosphere propagation: Skip distance, LUF, MUF, Critical freq, Variation of refractive index with height, effect of earth magnetize field on ionospheres propagation, calculation of refractive index dielectric constant & Conductivity for ionospheres. Ionospheres abnormalities.
Antenna Array: Multiplication of Pattern, Significance of Antenna Array, Broadside, and End fired, Uniform, and Parasitic feed in Antenna Array, Calculation of Directivity & B.W for Antenna array. Increased directed directive end fired array. Tapering of Array: Binomial Array, chebyshev array

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Jordan Balmian:- Electromagnetic Field Theory (PHI)
2. Kraus Antenna & Wave propagation (Mc Graw Hill)
3. Antenna & Wave propagation by K.D.Prasad (Satya Prakashan)
4. Collin R.E :- Antenna & Wave Propagation (TMH).

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-421N	**Non-Conventional Energy Sources**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Unit I

Introduction: Energy demand of world and country and gap analysis, Fossil fuel based systems, Impact of fossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy – sources and features, Hybrid energy systems. Distributed energy systems and dispersed generation (DG).

Unit II

Solar thermal systems: Solar radiation spectrum, Radiation measurement, Technologies, Applications, Heating, Cooling, Drying, Distillation, Power generation; Costing: Life cycle costing (LCC), Solar thermal system.

Solar Photovoltaic systems ,Operating principle, Photovoltaic cell concepts ,Cell, module, array, Series and parallel connections, Maximum power point tracking, Applications ,Battery charging, Pumping , Lighting,Peltier cooling , Costing: Life cycle costing ,Solar PV system

Unit III

Microhydel: Operating principle, Components of a microhydel power plant, Types and characteristics of turbines, Selection and modification, Load balancing, Costing: Life cycle costing -Microhydel

Wind; Wind patterns and wind data, Site selection, Types of wind mills, Characteristics of wind generators, Load matching, Life cycle costing - Wind system LCC

Unit IV

Biomass: Learning objectives, Operating principle, Combustion and fermentation, Anaerobic digester, Wood gassifier, Pyrolysis, Applications, Bio gas, Wood stoves, Bio diesel, Combustion engine, Life cycle costing - Biomass system LCC

Hybrid Systems, Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles

References:

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi
2. Mittal K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi
3. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi
4. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi

EEN-423N	Operating System	3	1	25	75	100	3 Hr

UNIT I

Introduction: Operating System Services-types.

File Systems: File concept, File support, Access methods, Allocation methods, Directory Systems, File protection.

CPU Scheduling: Review of multiprogramming concepts, scheduling concepts, Scheduling algorithms, Algorithm evaluation, multiple processor scheduling.

UNIT II

Memory Management: Bare machine concept, Resident monitor, Swapping-Multiple partitions, Paging, Segmentation, Combined systems, Virtual memory, Demand paging, Page replacement algorithms, Thrashing, Cache memory.

UNIT III

I/O Management And Disk Scheduling: Organization of I/O function, Logical structure and I/O buffering, Memory physical characteristics, First come first served scheduling,

Protection: Goals of protection, Mechanisms and policies, Domain of protection, Access matrix, Dynamic protection structure, Language based protection, Protection problems, Security. Round robin, Shortest seek time first scheduling, SCAN, CSCAN, LOOK, CLOOK, Selecting a disk scheduling algorithm, Sector queuing.

UNIT IV

Concurrency: Principle of concurrency, Mutual exclusion, Software support, Dekker's algorithm, Hardware support, Operating system support, Semaphore Implementation, Messages, Deadlock presentation , Deadlock detection, Deadlock avoidance, recovery.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. James L. Peterson and Abraham Silbersachatz, Operating System Concepts, Addison Wesley, World Students Series Edition, Second edition
2. Harvey M. Deitel, An Introduction to Operating Systems, Addison Wesley Publishing Company, Revised First edition
3. John J. Donovan, Systems Programming, McGraw Hill Book Co., International Student Edition

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-425N	Power System Planning	3	1	25	75	100	3 Hr

UNIT I

Load Forecasting: Introduction, Classification of loads, methods of load forecasting.
Scope of power system planning and design significance: Computer programming for planning, generation, transmission, Investment growth, generation cost.

UNIT II

Reliability of Transmission and Distribution System: Definition of reliability, bath tub Curve, Two state model, failure and repair rate, Probability density function, probabilities of survival and failure, mean time to failure, Mean down time, continuous Markov's process, reliability of series and parallel system, Approximate method, reliability planning, and perception of reliability models.

UNIT III

Reliability Schemes in Power System: Introduction, Marine power plant, Nuclear , Power plant, General Complex systems, Failure modes and effect analysis, Fault free Analysis of power systems.

UNIT IV

Operation and Control of Interconnected Power systems(AGC and SCADA): Main tasks planning , operation , accounting , Tasks of national control center, Regional control center, Generating station control room, Tasks of major substations, AGC- SCADA, Normal state - Restoration, system security, factors affecting security, load flow, state estimation.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Switch gear protection and power system by SUNIL S. RAO.
2. Power System Analysis and stability by S.S. Vadhera.
3. Power System Design and Analysis by B.R. Gupta
4. System Engg. & Reliability by L. S. Srinath

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-420N	**Computer Architecture and Organization**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Evolution of computers: Generation of computer system, different types of computers, characteristics of Von Neumann architecture, Limitation of computer systems, Parallel computer structures.

Instruction formats, addressing modes and instruction types: Principles of linear pipelining, Classifications of pipeline processor, Interleaved memory organizations, Instructions and arithmetic pipelines, Design examples, vector processing requirements, characteristics of vector processing.

UNIT II

Multiprocessor: Architecture, Functional structure, Loosely coupled multiprocessors, Tightly coupled multi processor, Processor characteristics for multiprocessing, Inter- connection networks, Time shared, crossbar switch and multiport memories and multistage networks for multiprocessors, classification of multiprocessor operating system.

UNIT III

AL Unit: Construction, Integer representation, Binary half adder, full adder, Parallel Binary adder, Addition and subtraction in a parallel arithmetic element, Full adder design, BCD adder, Positive and negative BCD number, Shift operations, Basic operations, Logic operations, Multiplexer, High Speed arithmetic.

Control Unit: Construction of an instruction work, Instruction cycle and execution cycle, organization of control registers, Instruction formats, Controlling arithmetic operations, Typical Sequence of operations, Instruction set, Register transfer language, Microprogramming- Micro instruction format, Simple micro program, Microprogramming applications.

UNIT IV

Memory: Basic concepts, memory device characteristics, semiconductor memories, static and dynamic memories. Random access and serial access memories. Memory hierarchies- cache, virtual, interleaved and associative memories.

I/O Devices: Input media, Keyboards, Mouse, Pointing Devices, character recognition (MICR & OCR), Output devices, CRT, Flat panel display, Printers, Tele printer (TTY).

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all , selecting at least one question from each unit.

References:

1. Hay, " Computer Architecture And Organizations" TMH
2. Stalling , "Computer Organization" PHI
3. Tannanbaum, "Structured Computer Organization" TMH

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-422N	**Radio & TV Engineering**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Radio Transmitter: Modulation, AM Transmitter, FM Transmitter; AFC,Sensitivity selectivity, VODAS, Radio Transmitter, Telephone transmitter Privacy device, Radio telegraph transmitter.

UNIT II

Radio receiver: TRF, super-heterodyne, communication receiver, double conversion receiver, SSB Rx, freq synthesis, image freq, selectivity. IF freq tracking AFC & AGC n Rx, FM demodulator, neutralization, freq drift & scintillation, Diversity reception, fading, Armstrong FM Rx.

UNIT III

Monochrome T.V: Introduction, composite video signal picture tube, camera tube image orthicon, vidicon, plumbicon TV Tx & Rx, modulation technique, TV Application CATV, CCTV, Video games Theater T.V., VTR, AGC, Various AGC system

UNIT IV

Color T.V.: Compatibility, three color theory different color picture tube, color signal transmission, NTSC, Color TV, PAL, SECAM

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all selecting at least one question from each unit.

References:

1. Monochrome & color T.V. by R.R.Gulati (Wiley Eastern Ltd.)
2. Radio Engineering by G.K. Mithal (Khanna Publications)
3. A.M Dhaka, " Monochrome & color T.V" (TMH)
4. Skolnik.M.I," Introduction to Radar System" (TMH)

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-424N	**Advanced Microprocessor and Interfacing**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

8086 Microprocessor: 8086 Internal Architecture timing diagram, interfacing 8086 to memory.

UNIT II

8086 Assembly Language Programs: 8086 instruction set, Assembler directive, program development method, writing simple 8086 programs for use with an assembler.

UNIT III

8086 Interrupts: 8086 Interrupts and Interrupt responses, hardware interrupt application.
Interfacing: Digital interfacing, Programming parallel port and handshake I/O, Interfacing a Microprocessor to keyboards & displays, Analog interfacing, introducing to A/D and D/A Converter & applications.

UNIT IV

Introduction to 80286, 80386, 80486 microprocessor and Single chip microcontrollers.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. V. Hall " Microprocessor & Interfacing Programming & Hardware-IInd Edition", TATA Mc Graw Hill.
2. A.P. Mathur ", Introduction Microprocessor–IIIrd Edition", (TMH)
3. Tabak. D," Advanced Microprocessor- Duglas 2nd edition," (TMH)

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-426N	**Digital Image Processing**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Digital Image Fundamentals: Introduction, image model, sampling and Quantization, relationship between pixels, imaging geometry, photographic film, discrete, Fourier transform, properties of two dimensional Fourier transform, fast Fourier transform.

UNIT II

Image Enhancement and Compression: Enhancement by point processing, spatial filtering and enhancement in the frequency domain, pseudo color image processing, image compression models, error free compression, image compression standards.

UNIT III

Image Restorations: Degradation, models, diagonalizations of matrices, inverse filtering, interactive restorations, geometric transformations.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region orienting segmentation.

UNIT IV

Representations and Recognition: Representations schemes, boundary descriptors, regional descriptors, morphology, recognition and interpretation, basics.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References

1. Rafael c. Gonzalez and Richard E. Woods, digital image processing, Addison Wesley publishing company
2. William K. Pratt, digital image processing, John Wiley and sons
3. Jain, Fundamentals of digital image processing, PHI
4. Barrie W. Jervis , "digital signal processing (Pearson education India)
5. Prokis, " digital signal processing" (PHI)

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-428N	**Software Engineering**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT- I

Introduction: Programs vs. Software products, Emergence of Software Engineering, Notable Changes in Software Development Practices, Software Life Cycle Models.

Software Project Management: Project Planning, Project Size Estimation Matrices, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO- A heuristic Estimation Technique, Halstead's

software Science- An Analytical Technique, Staffing Level Estimation, Scheduling, Organization and Team structures, Staffing, Risk Management, Software Configuration Management.

UNIT- II

Requirements Analysis and Specification: Requirements Analysis, Software Requirements Specification (SRS), Formal System Development Techniques, Algebraic Specifications, Software Design: Good Software Design/Practices, Cohesion and Coupling, Neat Hierarchy, Software Design Approaches.

Function-Oriented Software Design: Overview of the SA/DK Methodology, Structured Analysis, Data Flow Diagrams (DFDs), Extending the DFD Technique to Real Time Systems, Structured Design.

UNIT- III

Object Oriented Software Design: Overview of Object-Oriented Concepts, Object- Oriented vs. Function – Oriented Design, Graphical Representation of Object- Oriented Design, Object-Oriented Design Methodology.

User Interface Design: Characteristics of a Good User Interface Design, Basic Concepts, Command Language –Based Interface, Menu-Based Interface, Director Manipulation Interfaces, Windowing Systems, Types of Widgets, An overview of X Window/MOTIF, Visual C++.

UNIT-IV

Software Reliability and Quality Assurance: Software Reliability, Software Quality, Software, Software Quality Management, ISO 9000, SEI Capability Maturity Model. Computer Aided Software Engineering: CASE and its Scope, CASE Support in Software Architecture of a CASE Environment.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. Rajib Mall, " Fundamentals of Software Engineering", PHI
2. RogerS.Pressman ,"Software Engineering A Practitioner's Approach, McGraw-Hill.
3. Ali Behforooz and Frederich J. Hudson, " Software Engineering Fundamentals", Oxford University Press.

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EEN-430N	**Fuzzy Logic & Neural Networks**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

UNIT I

Introduction to Fuzzy sets, Crisp sets, Basic concepts of Fuzzy sets, L-fuzzy sets, level 2-fuzzy sets, type 2-fuzzy sets. Fuzzy sets Vs. Crisp sets. Fuzzy Arithmetic, Algebraic operations, set-theoretic operations, fuzzy relation on sets & fuzzy set compositions of Fuzzy relations, properties of the minimum-maximum composition.

UNIT II

Introduction to Fuzzy control, Fuzzy logic controller components, Construction of Fuzzy sets(Direct methods, Indirect method), Introduction to Expert system, Case study on fuzzy logic controller, Application of Fuzzy control.

UNIT III

Introduction to Neural Networks, Artificial Neuron model, Neural Network controller, Multilayer Network, Back propagation Algorithm (Forward, Backward), learning control Architecture (Indirect learning, General, Forward Inverse), Simplex matrix operation.

UNIT IV

Network Application of Neural: The traveling salesman problem, Time series prediction.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

References:

1. James A. Anderson “Introduction to Neural Networks”, Prentice Hall India.
2. H.J. Zimmermann “Fuzzy set theory & its Applications “, Allied Publishers Ltd.
3. Nil Junbong “Fuzzy Neural Control Principles & Algorithm”, PHI.
4. N.K. Bose “Neural Network Fundamental with Graphics “, TATA McGraw Hill.
5. Klir George J. “Fuzzy sets and Fuzzy Logic Theory and Applications”, PHI.
6. J.M Zurada , “ Introduction to Artificial Neural Network” , Jaico Publishers