Syllabus B.Tech. (Electrical Engineering), 4th semester

4EE1A:ANALOG ELECTRONICS (Common to EE, EX, EC and EI)

B.Tech. (Electrical) 4th semester **Max. Marks: 80**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
1	**Feedback Amplifiers:** Classification, Feedback concept, Feedback Topologies, Transfer gain with feedback, General characteristics of negative feedback amplifiers	5
	Analysis of voltage-series, voltage-shunt, current-series and current-shunt feedback amplifier. Stabilitycriterion. Compensation techniques, miller compensation.	3
2	**Oscillators &Multivibrators:** Classification. Criterion for oscillation.Tuned collector, Hartley, Colpitts, RC Phase shift, Wien Bridge and crystal oscillators	5
	Astable, monostable and bistablemultivibrators. Schmitt trigger. Blocking oscillators	3
3	**High Frequency Amplifiers:** Hybrid Pi model, conductances and capacitances of hybrid Pi model, high frequency analysis of CE amplifier	4
	Gain bandwidth product, unity gain frequency f_T.Emitter follower at high frequencies.	4
4	**Tuned Amplifier**: Band pass amplifier, Parallel resonant circuits, Band Width of Parallel resonant circuit. Analysis of Single Tuned Amplifier, Primary & Secondary Tuned Amplifier with BJT & FET	4
	Double Tuned Transformer Coupled Amplifier. Stagger Tuned Amplifier. Pulse Response of such Amplifier. Class C tuned amplifiers, Shunt Peaked Circuits for Increased Bandwidth.	4
5	**Power Amplifiers:** Classification, Power transistors & power MOSFET (DMOS, VMOS). Output power, power dissipation and efficiency analysis of Class A, class B, class AB, class C, class D and class E amplifiers as output stages.	4
	Pushpull amplifiers with and without transformers. Complementary symmetry & quasi complimentary symmetry amplifiers	4

Text Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	Millman, Integrated Electronics, ed. 2, TMH.	2010
2	A. S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Oxford university press.	2009

Reference Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	M. H. Rashid, Microelectronic Circuits Analysis and design, Cengage Learning.	2009
2	David A. BELL, Electronic Devices and Circuits, Oxford university press.	2009
3	Salivahnan, Electronics Devices and Circuits, ed. 3, TMH.	2011

4EE2A: CIRCUIT ANALYSIS-II

B.Tech. (Electrical) 4th semester **Max. Marks: 80**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
1	**Impedance and Admittance Functions:** The concept of complex frequency, transform impedance and admittance,series and parallel combinations	8
2	**Network Functions:** Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Restrictions on pole and zero location in s-plane.	5
	Time domain behavior from pole and zero plot. Procedure for finding network functions for general two terminal pair networks	3
3	**Network Synthesis:** Hurwitz polynomial, positive real functions, reactive networks. Separation property for reactive networks. The four-reactance function forms, specification for reactance function.	3
	Foster form of reactance networks. Cauer form of reactance networks. Synthesis of R-L and R-C networks in Foster and Cauer forms.	5
4	**Two Port General Networks:** Two port parameters (impedance, admittance, hybrid, ABCD parameters) and their inter relations. Equivalence of two ports.	2
	Transformer equivalent, inter connection of two port networks. The ladder network, image impedance, image transfer function, application to L-C network, attenuation and phase shift in symmetrical T and pi networks.	6
5	**Two Port Reactive Network (Filters):** Constant K filters. The m-derived filter. Image impedance of m-derived half (or L) sections, composite filters.	5
	Bands pass and band elimination filters. The problem of termination, lattice filters, Barlett's bisection theorem. Introduction to active filters.	3

Text Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	M. E. Van Valkenburg, An Introduction to Modern Network Synthesis, Wiley Eastern	2014
2	Nagsarkar & Sukhija, Circuits & Networks, Oxford	2011

Reference Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	M. E. Van Valkenburg, An Introduction to Modern Network Synthesis, Wiley Eastern	2008
2	Nagsarkar & Sukhija, Circuits & Networks, Oxford	2011
3	M. E. Van Valkenburg, An Introduction to Modern Network Synthesis, Wiley Eastern	2008
4	Nagsarkar & Sukhija, Circuits & Networks, Oxford	2011
5	M. E. Van Valkenburg, An Introduction to Modern Network Synthesis, Wiley Eastern	2008

4EE3A: ELECTRICAL MEASUREMENTS (Common to EE and EX)

B.Tech. (Electrical) 4th semester **Max. Marks: 80**

3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
1	**Measuring Instruments:** Moving coil, moving iron, electrodynamic and induction instruments-construction, operation, torque equation and errors. Applications of instruments for measurement of current, voltage, single-phase power and single-phase energy.	6
	Errors in wattmeter and energy meter and their compensation and adjustment. Testing and calibration of single-phase energy meter by phantom loading.	2
2	**Polyphase Metering:** Blondel's Theorem for n-phase, p-wire system. Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems: One-wattmeter, two-wattmeter and three-wattmeter methods. 3-phase induction type energy meter. Instrument Transformers: Construction and operation of current and potential transformers.	5
	Ratio and phase angle errors and their minimization. Effect of variation of power factor, secondary burden and frequency on errors. Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy.	3
3	**Potentiometers:** Construction, operation and standardization of DC potentiometers– slide wire and Crompton potentiometers. Use of potentiometer for measurement of resistance and voltmeter and ammeter calibrations.	4
	Volt ratio boxes. Construction, operation and standardization of AC potentiometer – in-phase and quadrature potentiometers. Applications of AC potentiometers.	4
4	**Measurement of Resistances:** Classification of resistance. Measurement of medium resistances – ammeter and voltmeter method, substitution method, Wheatstone bridge method.	4
	Measurement of low resistances – Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Price's Guard-wire method. Measurement of earth resistance.	4
5	**AC Bridges:** Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge and Anderson bridge for self-inductance measurement. Heaviside's bridge for mutual inductance measurement. De Sauty Bridge for capacitance measurement.	4
	Wien's bridge for capacitance and frequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components. Wagner earth device.	4

Text Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	H. S. Kalsi, Electronic Inst. & Measurement, TMH	2004
2	Morris, Electrical Measurements & Instrumentation, ELSEVIER	1997

Reference Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	Bell, Electronic Instrumentation And Measurement, Oxford	1994
2	W. D. Cooper, Electronic Inst. & Measurement Techniques, Prentice Hall, India.	2004
3	A. K. Sawhney, Electrical & Electronic Measurement & Inst, DhanpatRai& Sons	2002
4	E. W. Golding & F. C. Widdis, Electrical Measurement & Measuring Instrument, A.W. Wheeler	2004
5	Forest K. Harries, Electrical Measurement, Willey Eastern Pvt. Ltd. India.	2008

4EE4A: GENERATION OF ELECTRICAL POWER

B.Tech. (Electrical) 6th semester **Max. Marks: 80**
3L **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
1	**Conventional Energy Generation Methods :**(i) Thermal Power plants: Basic schemes and working principle. (ii) Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes.	5
	(iii) Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. (iv) Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants	3
2	**New Energy Sources:** Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming).Renewable and non-renewable energy sources	5
	Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction to electric energy generation by wind, solar and tidal.	3
3	**Loads and Load Curves:** Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization.	4
	Power Factor Improvement: Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers.	4
4	**Power Plant Economics:** (i) Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics.	5
	(ii) Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction: off peak energy utilization, co-generation, and energy conservation.	3
5	**(i) Tariffs:** Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three-part tariff. Spot (time differentiated) pricing.	4
	(ii) Selection of Power Plants: Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants.	4

Text Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	B. R. Gupta. Generation of Electrical Energy (4/e), S. Chand Publication.	2013
2	S. L. Uppal. Electrical Power (13/e), Khanna Publishers	2009

Reference Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	V. K. Mehta, Principles of Power system (3/e), S. Chand Publication	2005
2	Soni, Gupta and Bhatnagar, Generation of Electrical Power, Dhanpat Rai & Sons	1996
3	L. Elgerd Olle, Electric Energy Systems Theory, PHI	2013
4	C. A. Gross, Power System Analysis, TMH	1979

4EE5A: ELECTRICAL MACHINES –II (Common to EE and EX)

B.Tech. (Electrical) 6th semester **Max. Marks: 80**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
1	**AC Machines Fundamentals:** Introduction, emf equation, mmf of three phase AC winding, production of rotating magnetic field, types of AC windings	5
	Concentric, distributed and chorded windings, pitch factor, distribution factor, effect of these factors on induced emf, effect of harmonics.	3
2	**Polyphase Induction Motor**: Introduction. Construction, cage and wound rotors, principal, starting and running torque, condition for maximum torque, equivalent circuits, no load and block rotor test.	5
	Torque-slip characteristics, losses and efficiency, circle diagram, starting of cage and wound motors, speed control, cogging and crawling, double cage rotor, induction generator, application.	3
3	(i) **Single Phase Induction Motor:** Introduction, construction, principal, double revolving field theory, equivalent circuit, performance calculations, starting methods, and their types, torque slip characteristics of various types.	4
	ii) **Special Machines:** Single phase synchronous motor, series motor, universal motor, Stepper motors variable reluctance, permanent magnet and hybrid stepper motors.	4
4	**Synchronous Generators (Alternators):** Introduction, Construction, advantages of rotating field, types of rotors, emf equation, excitation systems, equivalent circuit and their phasor diagrams, voltage regulation, synchronous impedance method, mmf method.	5
	Zero power factor method, two reaction theory of salient pole rotor, phasor diagram, power developed and power angle characteristics of salient pole machine, determination of X_d and X_q, synchronization, synchronizing power and torque, parallel operation application.	3
5	**Synchronous Motors:** Introduction, construction, principal of operation, starting of synchronous motor, equivalent circuit and phasor diagrams, power and torque, performance calculation, speed torque characteristics, power factor control-effect of change of excitation.	4
	V curve and inverted V curve, synchronous condenser and reactors, synchronous phase modifiers, hunting-causes and remedies, applications, synchronous induction motor application.	4

Text Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	A. E. Fitzgerald, C. KingsleyJr and Umans, Electric Machinery, 6th Edition McGraw Hill, International Student Edition.	2002
2	Kothari & Nagrath, Electric Machines 3/e,TMH	2004

Reference Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	M. G. Say, The Performance and Design of AC machines, Pit man & Sons.	2002
2	Guru, Electric Machinery 3e, Oxford	2000
3	R. K. Srivastava, Electrical Machines, Cengage Learning.	2010
4	P. S. Bimbhra, Electrical Machinery, Khanna Pub.	1995
5	Stephen J Chapman, Electric Machinery Fundamentals, McGraw-Hill	2001
6	Husain Ashfaq, Electrical Machines, DhanpatRai & Sons	2012
7	Irving L. Kosow, Electric Machine and Tranformers, Prentice Hall of India.	1992

4EE6A: ADVANCED ENGINEERING MATHEMATICS-II (Common to EE and EX)

B.Tech. (Electrical) 4th semester **Max. Marks: 80**

3L **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
1	**Numerical Analysis:** Finite differences - Forward backward and central difference. Newton's forward and backward differences interpolation formulae. Sterling's formulae, Lagrange's interpolation formula. Solution of non-linear equations in one variable by Newton Raphson and Simultaneous algebraic equation by Gauss and Regula Falsi method.	6
	Solution of simultaneous equations by Gauss elimination and Gauss Seidel methods. Fitting of curves (straight line and parabola of second degree) by method of least squares.	2
2	**Numerical Analysis:** Numerical differentiation, numerical integration trapezoidal rule, Simpson's one-third and one eighth rule. Numerical Integration of ordinary differential equations of first order	5
	Picard's method, Euler's & modified Euler's methods. Miline's method and Runga Kutta fourth order method. Simple linear difference equations with constant coefficients.	3
3	**Special Functions:** Bessel's function of first and second kind, simple recurrence relations, orthogonal property of Bessel functions, Transformation, Generating functions	4
	Legendre's function of first kind, simple recurrence relations, orthogonal property, Generating functions.	4
4	**Statistics & Probability:** Elementary theory of probability, Baye's theorem with simple applications, Expected value.	4
	Theoretical probability distributions – Binomial, Poisson and Normal distributions.	4
5	**Statistics & Probability:** Lines of regression, co-relation and rank correlation.	4
	Transforms: Z-transforms, its inverse, simple properties and application to difference equations.	4

Text Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	Jeffrey, Advanced Engineering Mathematics, ELSEVIER	2006
2	Ervin Kreyzig, Advanced Engineering Maths, John Wiley	2010

Reference Books

S. No.	Name of authors'/books/publisher	Year of pub.
1	Bird, Higher Engineering Mathematics , ELSEVIER	2004
2	Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya	2002
3	Kaplan, W., Advanced Mathematics for Engineers, Addison-Wesley Publishing Co.	2008
4	Brigham, E.O., The Fast Fourier Transform and its Applications, Prentice-Hall	1988
5	J. N. Kapur, Mathematical Statistics, S. Chand & company Ltd	2000
6	R. K. Jain & S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Pub.	2002
7	E. Kreysig, Advanced Engineering Mathematics, John Wiley & Sons	2005

4EE7A: ANALOG ELECTRONICS LAB (Common to EE, EX, EC and EI)

1. Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1kHz with and without negative feedback.
2. Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor.
3. Plot and study the characteristics of small signal amplifier using FET.
4. Study of push pull amplifier. Measure variation of output power & distortion with load.
5. Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency.
6. Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.
7. Study the following oscillators and observe the effect of variation of C on oscillator frequency: (a) Hartley (b) Colpitts.
8. Design Fabrication and Testing of k-derived filters (LP/HP).
9. Study of a Digital Storage CRO and store a transient on it.
10. To plot the characteristics of UJT and UJT as relaxation.
11. To plot the characteristics of MOSFET and CMOS.

4EE8A: ELECTRICAL MEASUREMENT LAB (Common to EE and EX)

1. Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes.
2. Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter.
3. Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One-wattmeter method.
4. Calibrate an ammeter using DC slide wire potentiometer.
5. Calibrate a voltmeter using Crompton potentiometer.
6. Measure low resistance by Crompton potentiometer.
7. Measure Low resistance by Kelvin's double bridge.
8. Measure earth resistance using fall of potential method.
9. Calibrate a single-phase energy meter by phantom loading at different power factors.
10. Measure self-inductance using Anderson's bridge.
11. Measure capacitance using De Sauty Bridge

4EE9A:POWER SYSTEM DESIGN LAB

1. Generating station design: Design considerations and basic schemes of hydro, thermal, nuclear and gas power plants. Electrical equipment for power stations.
2. Auxiliary power supply scheme for thermal power plant.
3. Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin’s law.
4. Methods of short term, medium term and long term load forecasting.
5. Sending end and receiving end power circle diagrams.
6. Instrument Transformers: Design considerations of CTs & PTs for measurement and protection.
7. Substations: Types of substations, various bus–bar arrangements**.** Electricalequipment for substations.

4EE10A:ELECTRICAL MACHINE LAB (Common to EE and EX)

1. Speed control of D.C. shunt motor by (a) Field current control method & plot the curve for speed verses field current. (b) Armature voltage control method & plot the curve for speed verses armature voltage.
2. To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency.
3. To perform back-to-back test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit.
4. To determine the efficiency and voltage regulation of a single-phase transformer by direct loading.
5. To plot the O.C.C. & S.C.C. of an alternator and to determine its Z_s, X_d andregulation by synchronous impedance method.
6. To plot the V-curve for a synchronous motor for different values of loads.
7. To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit.
8. To perform no load and blocked rotor test on a 3 phase induction motor and to determine the parameters of its equivalent circuits. Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv) p.f. (v) Efficiency.
9. To Plot V-Curve and inverted V-Curve of synchronous motor.
10. To synchronize an alternator across the infinite bus (RSEB) and control load sharing.

4EE11A: ELECTRICAL MACHINE DESIGN (Common to EE and EX)

1. Design of transformers: output of transformer, output equation- volt per turn, core area and weight of iron &copper, optimum design–(i) minimum cost and (ii) minimum losses. Design of core and windings. Design a 3-phase transformer.
2. Design of rotating machines: General concepts. specific loading, output equations –dc machines and ac machines, factor affecting size of rotating machines, choice of specific magnetic and electric loadings.
3. Design of 3-phase induction motors: output equation, choice of air gap flux density and ampere conductors'parameter, main dimensions. Design of a 3-phase squirrel cage induction motor.
4. Design of single phase induction motors: output equation, main dimensions, relative size of single phase and 3-phase induction motors. Design of a single phase capacitor start induction motor.
5. Design of synchronous machines**:** output equation, choice of specific magnetic and electric loadings, main dimensions, short circuit ratio. Design a 3-phase, 2-pole turbo alternator.