GAUTAM BUDDHA UNIVERSITY

GAUTAM BUDH NAGAR-201310

SCHOOL OF ENGINEERING

COURSE SYLLABUS (1st /3rd/5th Semester)

(Five Years Integrated Dual Degree Programme (Electrical Engineering))

Batch 2011-16 onwards

5th Board of Studies Meeting (June 01, 2012)

DEPARTMENT OF ELECTRICAL ENGINEERING

School of Engineering

Gautam Buddha University
Gautam Budh Nagar-201310

SEMESTER-I				
Sr. No.	**Subject Code**	**Courses**	**L-T-P**	**Credits**
		THEORY		
1	CY101/PH102	Engineering Chemistry/Engineering Physics	3-1-0	4
2	MA101	Mathematics - I	3-1-0	4
3	CE101	Engineering Mechanics	2-1-0	3
4	CS101	Computer Programming - I	2-0-0	2
5	EE102	Electrical Technology	2-0-0	2
6	HU101	English Proficiency	2-0-0	2
7	SS101	Human Values & Buddhist Ethics	2-0-0	2
		PRACTICALS		
8	CY103/PH104	Engineering Chemistry / Engineering Physics Lab	0-0-2	1
9	ME102	Workshop Practices	0-0-3	2
10	CS181	Computer Programming Lab-I	0-0-3	2
11	EE104	Electrical Technology Lab	0-0-2	1
12	GP101	General Proficiency	-	1
		Total	**16-3-10**	**26**
		Total Contact Hours	29	

SEMESTER-III (session 2011-16 onward)

Sr. No.	**Subject Code**	**Courses**	**L-T-P**	**Credits**
		THEORY		
1	MA201	Quantitative Techniques	3-1-0	4
2	EE201	Electrical Engineering Materials	2-0-0	2
3	EE203	Network Theory	3-1-0	4
4	EE221	Electrical Measurement & Measuring Instruments	3-0-0	3
5	EE207	Electrical Machine-I	3-1-0	4
6	CS205	Data Structure and Algorithm	3-0-0	3
		PRACTICALS		
7	EE233	Circuit Analysis Lab	0-0-3	2
8	EE211	Electrical Machine Lab - I	0-0-3	2
9	EE231	Electrical Measurement & Measuring Instruments	0-0-2	1
10	GP201	General Proficiency	-	1
		Total	**17-3-8**	**26**
		Total Contact Hour	28	

SEMESTER – V (Session 2010-15 batch only)				
Sr. No.	**Subject Code**	**Courses**	**L-T-P**	**Credits**
		THEORY		
1	EE301	Transmission & Distribution of Electric Power	3-0-0	3
2	EE323/EE226	Signal & Systems	3-1-0	4
3	EE305	Control System-I	3-1-0	4
4	EE321	Electrical Measurement & Measuring Instruments	3-0-0	3
5	EE309	Power Electronics	3-0-0	3
6	ME311	Principles of Technology Management	2-0-0	2
		PRACTICALS		
7	EE313	Control System Lab	0-0-3	2
8	EE331	Electrical Measurement & Measuring Lab	0-0-3	2
9	EE333	Circuit Analysis Lab	0-0-3	2
10	GP301	General Proficiency		1
		Total	**17-2-9**	**26**
		Total Contact Hours	28	

SEMESTER – V (Session 2011-16 onward)				
Sr. No.	**Subject Code**	**Courses**	**L-T-P**	**Credits**
		THEORY		
1	EE301	Transmission & Distribution of Electric Power	3-1-0	4
2	EE303	Electromagnetic Field Theory	2-1-0	3
3	EE305	Control System-I	3-1-0	4
4	EE321	Digital Electronics	3-0-0	3
5	EE309	Power Electronics	3-0-0	3
6	ME311	Principles of Technology Management	2-0-0	2
		PRACTICALS		
7	EE313	Control System Lab	0-0-3	2
8	EE319	Digital Electronics Lab (Lab in ICT)	0-0-3	2
9	EE317	MATLAB Programming Lab (CAD Lab)	0-0-3	2
10	GP301	General Proficiency		1
		Total	**16-3-9**	**26**
		Total Contact Hours	28	

EE102: Electrical Technology **L-T-P: 2-0-0** **Credits: 02**

Module I: Elements and Circuits
Types of electrical elements & sources, Kirchhoff's laws, Node voltage and mesh current methods, Delta-star and star-delta conversion and Network theorems.

Module II: Single-phase AC Circuits
Average and effective values of sinusoidal quantities, form, crest and ripple factor, solution of R.L.C series circuits, the *j* operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, solution of parallel and series circuits.

Module III: Three-phase AC Circuits
Three phase voltages, line and phase quantities, balanced supply voltage and balanced load, problem of low power factor and methods for improvement.

Module IV: Magnetic Circuits and Transformer
Magnetic Circuits: B-H curve, solution of magnetic circuits, hysteresis and eddy current losses. Transformers: Construction, EMF equation, ratings, equivalent circuit, phasor diagrams, regulation and efficiency calculations, open and short circuit tests.

Module V: Electrical Machines
Construction, principle, characteristics of DC machines, applications of DC machines.

Text Books:
1. Basic Electrical Engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition.
2. Basic Electrical Engineering, T. K. Nagsarkar & M.S. Sukhija, Oxford Publication.
3. Basic Electrical Engineering, V.N. Mittle and A. Mittal, TMH, Second Edition

Reference Books:
1. Electrical Engineering Fundamental, Vincent.D.Toro, Pearson Education, Second Edition.
2. Electrical & Electronics Technology, 8/e, Hughes, Pearson Education.
3. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH.
4. Basic Electrical Engineering, J.J. Cathey & S.A Nasar, TMH, Second Edition.

EE201: Electrical Engineering Materials L-T-P: 2-0-0 Credit: 2

Module 1: Conducting Material

Classification and main properties, High resistivity alloy: Constant Mangann, Nichrome, Electrochemical, properties of copper, Aluminum, steel tungsten, Molybdenum, Platinum, Tantalum, Niobium, Mercury, Nickel, Titanium, Carbon, Lead, thermal, Bimetals, thermocouple, materials, specific resistance, conductance, variation of resistance with temperature, super conductors.

Module 2: Semi Conductor Materials

General conception, variation of electrical conductivity, Elements having semiconductor properties, general application, hall effect, energy levels, conduction in semiconductors, Intrinsic conduction, impurity conduction, P and N type impurities, electrical change, Neutrality, Drift, Mobility current flow in semi conductors P-N junction formation by alloying, Elasing (forward and reverse) of P-n junction, Reverse separation current, Zener effect, Junction, capacitance, hall defects and hall coefficient.

Module 3: Magnetic Materials

Details of magnetic materials, reduction between B.H. and μ, soft and hard magnetic materials. Di-magnetic, Para magnetic and Ferromagnetic materials, electrical sheet steel, cast iron. Permanent magnetic materials. Dynamic and static hysteresis loop. Hysterisis loss, eddy current loss, Magnetisation, magnetic susceptibility, coercive force, core temperature, rectangular hysteresia loop, Magnet rest square loop core materials, iron silicon, Iron alloys.

Module 4: Insulating Materials

General electrical mechanical and chemical properties of insulating material, Electrical characteristics volume and surface resistivity complex permittivity loss, and dielectric loss, equivalent circuits of an imperfect dielectric polarization and polarisability classification of dielectric.

Module 5: Mechanical Properties

Classification insulating materials on the basis of temperature rise, General properties of transformer oil, commonly used varnishes, solidifying insulating materials, resins, bituminous waxes, drying oils, Fibrous insulating materials, wood, paper and cardboard, insulating textiles, varnished adhesive tapes, inorganic fibrous material and other insulating materials, such as mica, ceramic, bakelite, ebonite, glass, PVC, rubber, other plastic molded materials.

References:

1. TTTI Madras; Electrical Engineering Materials; TMH.
2. Dekkor AK; Electrical Engineering Materials; PHI.
3. Indulkar and S. Thruvengadem; Electrical Engineering Materials; S. Chand
4. Ian P. Jones Materials Science for Electrical and Electronic; Oxford
5. Engineers Electrical Engineering Material s & Devices; John Allison ;TMH

EE203: NETWORK THEORY L-T-P- 3-1-0 Credit: 4

Evaluation Scheme:

TA		Examination	
Quizzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Class participations	: 5%		

Module 1: Network Theorems for AC applications:
AC circuits: Circuits containing capacitors and inductors, Transient response, Thevenin's theorem, Norton's theorem, Super-position theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's theorem and Substitution theorem.

Module 2: Graph Theory:
Graph of a Network, definitions, tree, Co-trees, link, Properties of trees, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix and loop currents, Number of possible trees of a graph, Loop and Nodal methods of analysis.

Module 3: Transient Analysis:
Network Equations, Intitial Conditions, Procedure for evaluating initial conditions, RL & RC circuits.
Laplace Transformation, Laplace transform of some important function, transformed circuit, RL, RC & RLC circuit, Transient and steady state response of RL and RC circuit to various functions.

Module 4: Network Functions and Two port Networks:
Network function , Concept of Complex frequency, Transform Impedances Network functions of one port and two port networks, Necessary conditions for driving point and transfer functions, concept of poles and zeros, time response and stability from pole zero plot. Two port parameters- Z, Y, ABCD and h parameters, reciprocity and symmetry, Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T & Π Representation.

Module 5: Network Synthesis:

Hurwitz polynomials, positive real functions. Properties of real immittance functions, synthesis of LC driving point immittances, properties of RC driving point impedances, synthesis of RC impedances or RL admittances, properties of RL impedances and RC admittances.
Introduction to filters:

Text Books

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. A.Chakrabarti, "Circuit Theory" Dhanpat Rai & Co.
3. C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers.
4. D. Roy Choudhary, "Networks and Systems" Wiley Eastern Ltd.
5. Donald E. Scott: "An Introduction to Circuit analysis: A System Approach" McGraw Hill

Reference Books

1. M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
2. A Ramakalyan, "Linear Circuits: Analysis and Synthesis" Oxford University Press.
3. W.H. Hayt, J.E Kemmerly & S.M Durbin, "Engineering Circuit Analysis", 7/e, McGraw Hill.

EE205/EE 321: Electrical Measurements and Measuring Instruments

L T P 3-0-0 Credit: 3

Evaluation Scheme:

TA		Examination	
Quizzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Class participations	: 5%		

MODULE-I

a. Philosophy of Measurement: Methods of measurement, measurement system**,** classification of instruments and their study, characteristics of instruments & measurement system, Errors in measurement & its Statistical analysis, Standards.

b. Analog Measurement of Electrical Quantities : Electrodynamic, Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters, Electrodynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, Errors & remedies in wattmeter and energy meter.

MODULE -II

Measurement of Parameters: Different methods of measuring low, medium and high resistances**,** Measurement of low, medium and high Inductance and capacitance with AC bridges, Q Meter, Frequency meter, speedometer.

MODULE - III

a. AC/DC Potentiometers: Polar type & Co-ordinate type potentiometers, self balancing potentiometer, applications of Potentiometers in Electrical Measurement & instrumentation.

b. Magnetic Measurement: Ballistic Galvanometer, flux meter**,** determination of hysteresis loop, measurement of iron losses**,** Determination of B-H curve, magnetic measurement applications.

MODULE-IV

Instrument transformers and their applications in the extension of instrument range, CTs & PTs, measurement of speed, power, power frequency and power factor, VAR meter, Energy meter and its applications.

MODULE - V

a. Digital Measurement of Electrical Quantities: Concept of digital measurement, study of digital voltmeters, frequency meter, power analyzer and harmonics analyzer; electronic multimeter.

b. Cathode Ray Oscilloscope (CRO): Introduction of CRO, Basic CRO circuit, cathode ray tube (CRT) & its components, applications of CRO in measurement, Lissajous Patterns, Dual trace & Dual beam Oscilloscopes.

Text Books:

1. A.K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Sons, India
2. W.D.Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International, India.
3. J.B. Gupta, "Electrical Measurements and Measuring Instruments", S.K. Kataria & Sons, Delhi.

Reference Books:

1. E.O. Doebelin and D. N. Manik, "Measurement systems application and design", 5th Ed., TMH, 2007, New Delhi.
2. E.W. Golding & F.C. Widdis, "Electrical Measurement & Measuring Instruments", A.W. Wheeler & Co. Pvt. Ltd. India.
3. Forest K. Harries,"Electrical Measurement",Willey Eastern Pvt. Ltd. India .
4. M.B. Stout ,"Basic Electrical Measurement" Prentice hall of India,India.
5. Oliver and Cage, "Electronic Measurements and Instrumentation", TMH, 2009.
6. Rajendra Prasad , "Electrical Measurement &Measuring Instrument" Khanna Publisher, Delhi.

EE207:Electrical Machine-I **L-T-P: 3-1-0** **Credit: 4**

Module1: Electromechanical Energy Conversion

Introduction, Flow of Energy in Electromechanical Devices, Determination of mechanical force, Mechanical energy, Torque equation, Singly Excited Systems, Doubly excited Systems, Energy stored in a magnetic field, Electromagnetic torque, Equation of generated EMF in a machines, torque in machines with cylindrical air gap.

Module 2: DC Generators

Construction, Types of DC generators, emf equation, lap & wave windings, equalizing connections, armature reaction, commutation, methods of improving commutations, demagnetizing and cross magnetizing mmf, Interpoles and Compensating Windings, Characteristics of D.C. generators, parallel operation. Rosenberg generator.

Module 3: DC Motors

Principle, back emf, types, production of torque, armature reaction & interpoles, characteristics of shunt, series & compound motor, DC motor starting. Speed Control of DC Motor: Armature voltage and field current control methods, Ward Leonard method. Braking, losses and efficiency, direct & indirect test, Swinburne's test, Hopkinsion test, field & retardation test, single-phase series motor.

Module 4: Transformers

Construction, types, emf equation. No load and load conditions. Equivalent circuits, Vector diagrams, OC and SC tests, Sumpner's back-to-back test, efficiency. Voltage regulation, effect of frequency, parallel operation, autotransformers, switching currents in transformers, separation of losses.

Module 5: Polyphase Transformers

Single unit or bank of single-phase units, polyphase connections, Open delta and V connections, Phase conversion: 3 to 6 phase and 3 to 2 phase conversions, Effect of 3-phase winding connections on harmonics, 3-phase winding transformers, tertiary winding.

Text Books

1. M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.
2. Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" Oxford
3. A.E. Fitggerald, C.Kingsley Jr and Umans,"Electric Machinery", 6th Edition McGraw Hill, International Student Edition.

Reference Books

1. Irving L. Kosow, "Electric Machine and Tranformers", Prentice Hall of India.
2. P.S.Bimbhra, "Electrical Machinery", Khanna Publisher.

EE-209: Network Theory Laboratory L-T-P: 0-0-2 Credit: 1

1. Verification of principle of superposition with DC and AC sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in AC circuits
3. Verification of Tellegen's theorem for two networks of the same topology
4. Determination of transient response of current in RL and RC circuits with step voltage input
5. Determination of frequency response of current in RLC circuit with sinusoidal AC input
6. Determination of Z and Y parameters for a network and compare with theoretical results.
7. Determination of h and ABCD parameters for a network and compare with theoretical results
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values
9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests
10. Verification of parameter properties in inter-connected two port networks: series, parallel and cascade also study loading effect in cascade.
11. To determine attenuation characteristics of a low pass, high pass and band pass filters.

(List of Experiments (PSPICE based)

1. Study of various commands of PSPICE.
2. To determine node voltages and branch currents in a resistive network.
3. To obtain Thevenin's equivalent circuit of a resistive network.
4. To obtain transient response of a series R-L-C circuit for step voltage input.
5. To obtain transient response of a parallel R-L-C circuit for step current input.
6. To obtain transient response of a series R-L-C circuit for alternating square voltage waveform.
9. To plot magnitude, phase and step response of a network function.
10. To determine z, y, g, h and ABCD parameters of a two port network.

Reference Books:

1. Irvine, Calif, "PSPICE Manual" Microsim Corporation, 1992.
2. Paul W. Tuinenga, "SPICE: A guide to circuit Simulation and Analysis Using PSPICE", Prentice Hall, 1992.
3. M.H. Rashid, "SPICE for Circuits and Electronics Using PSPICE" Prentice Hall of India, 2000.

EE-211:-Electrical Machine Lab-I **L-T-P: 0-0-3** **Credit: 2**

Evaluation Scheme:

TA		**Examination**	
Qiuzzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Lab participations	: 5%		

LIST OF EXPERIMENT

1. To perform polarity and ratio test of single phase and 3-phase transformers.
2. To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformer using O.C. and S.C. tests.
3. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test.
4. To obtain 3-phase to 2-phase conversion by Scott connection.
5. To determine excitation phenomenon (B.H.loop) of single phase transformer using C.R.O.
6. To study the various three phase transformer connections, Y-Y, Y-Δ, Δ-Y, Δ-Δ.
7. To obtain magnetization characteristics of a d.c. shunt generator.
8. To obtain load characteristics of a d.c. shunt generator and compound generator (a) Cumulatively compounded (b) Differentially compounded.
9. To obtain efficiency of a dc shunt machine.
10. To obtain speed-torque characteristics of a dc shunt motor.
11. To obtain speed control of dc shunt motor using (a) armature control method (b) Field control method.
12. To obtain speed control of dc separately excited motor using Conventional Ward-Leonard/Static Ward –Leonard method.

EE-215: Electrical Measurements and Instrumentation Lab

L-T-P: 0-0-2 Credits 01

LIST OF EXPERIMENTS

1. Calibration of ac voltmeter and ac ammeter.
2. Measurement of voltage, current and resistance using dc potentiometer.
3. Measurement of low, medium and high resistance by bridge method.
4. Measurement of low, medium and high inductance by bridge method.
5. Measurement of low, medium and high capacitance by bridge method.
6. Measurement of form factor of a rectified sine wave and determination of source of error.
7. Measurement of phase and frequency of a sinusoidal ac voltage using CRO & study of Lissajous patters.
8. Measurement of power and power factor of a I-Phase inductive load and to study effect of capacitance connected across the load on the power factor.
9. Measurement of displacement by Inductive/Capacitive transducers.
10. Study of strain gauges and measurement of displacement by using strain gauge.
11. Measurement of pressure using pressure transducer.
12. Measurement of humidity using capacitive/inductive transducer.
13. Measurement of ECG, EEG & EMG Signals.
14. Study of respiratory system and its measurement.
15. Two experiments based on simulation in MATLAB/ LABVIEW

*** A minor project based on Measurement Instrumentation to be carried out by the group of 3 students (Optional).**

*** The faculty may add few more experiments if he/she desires as per the available time (Optional).**

*** One industrial trip of students may be arranged particularly to an Instrumentation/automation Industry (Optional).**

Note: From the above list, minimum 10 experiments are required to be completed two from each group.

EE301: Transmission & Distribution of Electric Power **L-T-P: 3-0-0**
Credit:3

Evaluation Scheme:

TA		Examination	
Quizzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Class participations	: 5%		

Module-1 (i) Supply systems: - Basic network of power system. Transmission and distribution voltage, effect of system voltage on size of conductor and losses (ii) Mechanical features of overhead lines: - Conductor material and types of conductor, Conductor arrangements and spacing. Calculation of sag and tension supports at different levels, effect of wind and ice loading, stringing chart and sag template. Conductor vibrations and vibration dampers.

Module-2 Parameters of Transmission Lines: Resistance inductance and capacitance of overhead lines, effect of earth, line transposition. Geometric mean radius and distance. Inductance and capacitance of line with symmetrical and unsymmetrical spacing Inductance and capacitance of double circuit lines. Skin and proximity effects. Equivalent circuits and performance of short medium and long transmission lines.

Module-3 (i) Generalized ABCD line constants, equivalent circuit and performance of long transmission line. Ferranti effect. Interference with communication circuits. Power flow through a transmission line (ii) Corona: Electric stress between parallel conductors. Disruptive critical voltage and visual critical voltage, Factors affecting corona. Corona power loss. Effects of corona

Module-4 (i) Insulators: Pin, shackle, suspension, post and strain insulators. Voltage distribution across an insulator string, grading and methods of improving string efficiency. (ii) Underground Cables: Conductor, insulator, sheathing and armoring materials. Types of cables. Insulator resistance and capacitance calculation. Electrostatic stresses and reduction of maximum stresses. Causes of breakdown. Thermal rating of cable. Introduction to oil filled and gas filled cables

Module-5 Distribution Systems: -Primary and secondary distribution systems, feeder, distributor and service mains. Radial and ring- main distribution systems. Kelvin's law for conductor size.

TEXT BOOKS

1. C.L. Wadhwa 'Generation, Distribution and Utilization of Electrical Energy', New Age International
2. D.P.Kothari and I.J.Nagrath, 'Modern Power System Analysis', Tata McGraw Hill publishing company ltd, fourth edition, 2012
3. S. N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi
4. B. R. Gupta, 'Power System Analysis and Design', S. Chand, New Delhi

REFERENCE BOOKS

1. Hadi Saadat, ' Power System Analysis, Tata McGraw Hill Publishing company
2. V.K.Mehta and Rohit Mehta, 'Principles of Power System', S.Chand and Company Ltd, second edition,2006

EE-323/EE-226: SIGNALS AND SYSTEMS L T P 3 1 0. Credit: 4

Evaluation Scheme:

TA		Examination	
Quizzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Class participations	: 5%		

UNIT I: Introduction to continuous time signals and systems:

Signals: Basic continuous time signals, unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics. signal operations: scaling, shifting and inversion; signal properties: symmetry, periodicity and absolute integrability, Signal representation: signal space and orthogonal bases;

Systems: system properties: linearity, time/shift-invariance, causality, stability; continuous-time linear time invariant (LTI) and discrete-time linear shift invariant (LSI) systems: impulse response and step response; response to an arbitrary input: convolution; system representation using differential and difference equations; Eigen functions of LTI/ LSI systems.

UNIT II: Laplace Transform Analysis:

Review of Laplace Transform, Laplace Transform of periodic functions, Initial and Final Value Theorems, Inverse Laplace Transform, Convolution Theorem, Application of Laplace Transform to analysis of networks, waveform synthesis.

UNIT III: Fourier Transform Analysis:

Fourier series: Fourier series representation of continuous-time and discrete-time signals; Exponential form and Trigonometric form of Fourier series, Fourier symmetry.

Fourier Transform: Fourier transform and Fourier Integral, Fourier transformation theorem, Transform of common functions and periodic wave forms, Applications of Fourier Transform to network analysis. Discrete-time Fourier transform and its properties.

UNIT IV: Z-Transform Analysis:

Z-Transform, Region of convergence, properties, Z-Transform of common functions, Inverse Z Transform, System function and pole zero plot from z-transform, stability in terms of z-transform. Discretization of analog signals- Sampling, sampling theorem, aliasing; signal reconstruction: ideal interpolator, zero-order hold, first-order hold. Effect of under sampling.

Text Books:

1. M. J. Roberts, "Fundamentals of Signals and Systems", Tata McGraw Hill, 2007.
2. B.P. Lathi, “Linear Systems & Signals” Oxford University Press, 2008.
3. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons, 1998.
4. Samarjeet Ghosh, “Signals and Systems”, Pearson, 2006.

References:

1. A.V. Oppenheim, A.S. Willsky and H.S. Nawab, "Signals and Systems", PHI, 2006.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4/e, Prentice Hall, 1998.
3. I.J. Nagrath, S.N. Saran, R. Ranjan and S.Kumar, “Singnals and Systems, “Tata Mc. Graw Hill, 2001.

EE 303: Electromagnetic Field Theory **L-T-P: 3-1-0** **Credits: 04**

Evaluation Scheme:

TA		Examination	
Quizzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Class participations	: 5%		

Module 1: Review of Vector algebra and Coordinate Systems

Vector operations, del, gradient, divergence and curl operator, Cartesian, cylindrical and spherical coordinate systems, Relations among these coordinate system

Module 2: Electrostatic Fields

Electric potential, Electric field intensity, Field due to line and surface charge, Electric dipole, Gauss law and its applications for spherical and cylindrical geometries, Laplace and Poission's equation in various coordinate systems, Capacitance and the effect of dielectric, Boundary conditions at electric interfaces. Method of images

Module 3: Magnetic Fields

Magnetic field due to electric current, Bio-Savert law, magnetic flux, flux density and magnetic field intensity, interaction of currents and fields, Amperes law, Magnetic vector potential, Boundary conditions at magnetic interfaces

Module 4: Electromagnetic Field

Faraday's law, self and mutual inductance of transmission lines and cables, Energy stored in Electric and Magnetic fields

Module 5: Time Varying Field

Continuity of charge, Displacement current, Maxwell's equation in integral and differential form for static and time varying fields

Applications

Poynting vector, Poynting's theorem, Power loss in a plane conductor
Polarization, Reflection and Refraction of plane waves at surface interface, surface impedance
TE, TM and TEM wave propagation
Circuit representation of parallel plane transmission lines, Transmission lines with losses, Line theory, Smith Chart.

Text Books

1. Mathew N.O. Sadiku, "Elements of Electromagnetics", Third Edison, Oxford University Press
2. W.H. Hayt, "Engineering Electromagnetics", Tata Mc Graw-Hill publications

Reference Books

1. D.K. Cheng, "Fields and wave Electromagnetic", Second Edison, Addison-Wesley Press
2. Joseph Edminister, "Schaum's outline of Electromagnetics", Schaum's outline series
3. John D. Kraus, "Electromagnetics" McGraw Hill, 4th Edition
4. N. Narayana Rao, "Elements of Engg. Electro Magnetics", Prentice Hall of India, 3rd Edition.

EE305: CONTROL SYSTEM-I L T P 3-1-0 Credit: 4

Evaluation Scheme:

TA		Examination	
Quizzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Class participations	: 5%		

Unit-I: Systems and their representations:
Basic elements in control systems – Open and closed loop systems, Effect of feedback. Mathematical Models for Physical Systems - Mechanical translational and rotational systems; Gear train, Electrical Systems, Electrical analogy of mechanical systems, Transfer function.
Block diagram Algebra for SISO and MIMO systems, block diagram reduction techniques. Signal flow graphs- Mason's gain formula

Control System Components- Construction and working concept of AC, DC servomotor, synchros and stepper motor.

Unit-II: Time Response analysis:
Standard test signals, time response of first and second order systems, time response specifications of second order system, steady state errors and error constants, Effect of adding poles and zeros to a transfer function, Response with P, PI and PID controllers, performance indices

Unit-III: Stability of Control Systems:
Characteristic equation, Concept of stability, necessary and sufficient conditions for stability, Routh- Hurwitz criterion, relative stability, Root locus construction, Effect of pole-zero addition

Unit-IV: Frequency response Analysis:
Frequency response, correlation between time and frequency responses, polar plots, Bode plots, Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, closed loop frequency response, M & N Circles, Nichhol's chart.

Unit-V: State-variable representation of systems:
Phase variables, Canonical variables, diagonalization, solution of state equations, state transition matrix, conversion of state variable model to transfer function model and vice-versa, Controllability and observability and their testing.

Text Books:

1. I. J. Nagrath & M. Gopal, "Control System Engineering", 4th Edition, New age Int.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India, 2002.
3. B.C. Kuo, "Automatic Control System", 8/e Wiley India Ltd, 2008.

Reference Books:

1. Norman S. Nise, Control System Engineering 4th edition, Wiley Publishing Co.
2. D'Azzo and Houpis, Feedback Control Systems, Analysis and Synthesis with MATLAB, ISBN:0824740386
3. G. F. Franklin, J. D. Powell and A. E. Emami-Naeini, Feedback Control of Dynamic Systems; Prentice Hall Inc., 2002.
4. M. Gopal, "Control Systems: Principles & Design" Tata Mc Graw Hill.
5. R. C. Dorf and R. H. Bishop, "Modern Control Systems, PHI Publication, 12th Edition, 2011.

EE309: Power Electronics **L T P 3-0-0** **Credit: 3**

Evaluation Scheme:

TA		Examination	
Quizzes	: 10%	Mid Term	: 25%
Assignments	: 10%	End Term	: 50%
Class participations	: 5%		

Module-I

Introduction: Common Power semiconductor devices, static and dynamic characteristics of Thyristors, Turn-on and off methods and circuits, various protection of SCR and Ratings, other members of thyristor family, series and parallel operation of SCR, firing circuits for SCR, Recent power semiconductor devices and their characteristics

Module-II

AC to DC Converters: Principle of phase control, single phase half wave circuit with R and R-L loads, single phase and three phase semi converter and full converter bridge circuits with line commutation, continuous and discontinuous conduction, effect of source inductance on single phase and three phase full converters, single phase and three phase dual converters and their operation with circulating and non circulating currents.

Module-III

DC to DC Converters: Principle of operation of chopper, controlling methods, step up choppers, types of choppers, steady state time domain analysis with R, L, and E type loads, Voltage, Current and Load commutated choppers.

Module-IV

DC to AC Converters: Single phase inverter, half bridge and full bridge inverters and their steady state analysis, Mc Murray inverter, Series inverters, and three phase bridge inverters with 120^{o} and 180^{o} modes, Single-phase PWM inverters. Various PWM techniques, Current source inverters, operation of CSI with R load

Module-IV

Cyclo-Converters: Principles of operation, single phase to single phase step up and step down cyclo-converters. Three phase to single phase and three-phase to three-phase cycloconverters, output equation for a cyclo-converter

Module-V

AC Voltage Controllers: Types of single-phase voltage controllers, Single-phase voltage controller with R and RL type of loads. Three phase voltage controller configurations R Load

Text Books

1. M.H. Rashid, “Power Electronics: Circuit, Devices and Applications”, Prentice Hall, 2004.
2. P.S. Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi

Reference Books

1. N. Mohan, M. Underland, William P. Robbins, “Power Electronics Converters, applications and design”, John Wiley & sons, Singapore, 2001.
2. M.D. Singh, K.B. Khanchandani, “Power Electronics”, Tata McGraw Hill, New Delhi, 2001.
3. Cyril W.Lander, “Power Electronics”, McGraw-Hill, International edition, New Delhi, 1993.
4. Williams B.W., “Power Electronics Devices, drivers, applications and passive components”, McMillan Press Ltd., London, 1992.

EE-313: CONTROL SYSTEM LABORATORY L-T-P 0-0-3 Credit: 2

1. To determine response of first order systems for step input and observe the effect of time constant
2. To determine response of second order system for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
3. To obtain the time domain specifications of a second order system and observe the effect of damping.
4. To study the behavior of type 0, type-1 and type-2 system for step, ramp and parabolic input
5. To determine speed-torque characteristics of DC servo motor.
6. To study synchro-transmitter and receiver and obtain output v/s input characteristics
7. To determine speed-torque characteristics of an AC servomotor.
8. To study performance of servo voltage stabilizer at various loads using load bank.
9. To study behaviour of separately excited dc motor in open loop and closed loop conditions at various loads.
10. To study P, PI and PID temperature controller for an oven and compare their performance.
11. To study PID Controller for simulation proves like transportation lag.

Software based experiments (Use MATLAB, LABVIEW software etc.)

12. To determine time domain response of a second order system for step input and obtain performance parameters.
13. To convert transfer function of a system into state space form and vice-versa.
14. To plot root locus diagram of an open loop transfer function and determine range of gain 'k' for stability.
15. To plot a Bode diagram of an open loop transfer function.
16. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.

EE-331 Electrical Measurements and Instrumentation Lab

L-T-P: 0-0-3 Credits 02

LIST OF EXPERIMENTS

1. Calibration of ac voltmeter and ac ammeter.
2. Measurement of voltage, current and resistance using dc potentiometer.
3. Measurement of low, medium and high resistance by bridge method.
4. Measurement of low, medium and high inductance by bridge method.
5. Measurement of low, medium and high capacitance by bridge method.
6. Measurement of form factor of a rectified sine wave and determination of source of error.
7. Measurement of phase and frequency of a sinusoidal ac voltage using CRO & study of Lissajous patters.
8. Measurement of power and power factor of a I-Phase inductive load and to study effect of capacitance connected across the load on the power factor.
9. Measurement of displacement by Inductive/Capacitive transducers.
10. Study of strain gauges and measurement of displacement by using strain gauge.
11. Measurement of pressure using pressure transducer.
12. Measurement of humidity using capacitive/inductive transducer.
13. Measurement of ECG, EEG & EMG Signals.
14. Study of respiratory system and its measurement.
15. Two experiments based on simulation in MATLAB/ LABVIEW

*** A minor project based on Measurement Instrumentation to be carried out by the group of 3 students (Optional).**

*** The faculty may add few more experiments if he/she desires as per the available time (Optional).**

*** One industrial trip of students may be arranged particularly to an Instrumentation/automation Industry (Optional).**

Note: From the above list, minimum 10 experiments are required to be completed two from each group.

EE-333: Circuit Analysis Laboratory L-T-P: 0-0-2 Credit: 1

1. Verification of principle of superposition with DC and AC sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in AC circuits
3. Verification of Tellegen's theorem for two networks of the same topology
4. Determination of transient response of current in RL and RC circuits with step voltage input
5. Determination of frequency response of current in RLC circuit with sinusoidal AC input
6. Determination of Z and Y parameters for a network and compare with theoretical results.
7. Determination of h and ABCD parameters for a network and compare with theoretical results
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values
9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests
10. Verification of parameter properties in inter-connected two port networks: series, parallel and cascade also study loading effect in cascade.
11. To determine attenuation characteristics of a low pass, high pass and band pass filters.

(List of Experiments (PSPICE based)

1. Study of various commands of PSPICE.
2. To determine node voltages and branch currents in a resistive network.
3. To obtain Thevenin's equivalent circuit of a resistive network.
4. To obtain transient response of a series R-L-C circuit for step voltage input.
5. To obtain transient response of a parallel R-L-C circuit for step current input.
6. To obtain transient response of a series R-L-C circuit for alternating square voltage waveform.
9. To plot magnitude, phase and step response of a network function.
10. To determine z, y, g, h and ABCD parameters of a two port network.

Reference Books:

1. Irvine, Calif, "PSPICE Manual" Microsim Corporation, 1992.
2. Paul W. Tuinenga, "SPICE: A guide to circuit Simulation and Analysis Using PSPICE", Prentice Hall, 1992.
3. M.H. Rashid, "SPICE for Circuits and Electronics Using PSPICE" Prentice Hall of India, 2000.