Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
Third Semester Electrical (Electronics & Power) Engineering

Course Category	Course Code	BoS	Course Title	Teaching Scheme				Examination Scheme									
				Hours per week			No. of credits	THEORY						PRACTICAL			
				L	T	P		Duration of paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional MSE	Max. Marks Sessional IE	Total	Min. Passing Marks	Max Marks TW	Max Marks POE	Total	Min. Passing Marks
ESC	SE101	Applied Mechanics	Engineering Mechanics	3	1	0	4	3	80	10	10	100	40	--	--	--	--
PCC	SE102	Electrical	Electrical Circuit Analysis	3	1	0	4	3	80	10	10	100	40	--	--	--	--
PCC	SE103	Electronics	Analog Electronics	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	SE104	Electrical	Electrical Machines-I	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	SE105	Electrical	Electromagnetic Fields	3	1	0	4	3	80	10	10	100	40	--	--	--	--
Laboratory																	
PCC	SE106	Electrical	Electrical Circuit Analysis Laboratory	0	0	2	1	--	--	--	--	--	--	25	25	50	25
PCC	SE107	Electronics	Analog Electronics Laboratory	0	0	2	1	--	--	--	--	--	--	25	25	50	25
PCC	SE108	Electrical	Electrical Machines-I Laboratory	0	0	2	1	--	--	--	--	--	--	25	25	50	25
MC	SE109	S&H	Slot for MC	-	-	-	0	--	--	--	--	--	--				
		Total		**15**	**3**	**6**	**21**					**500**				**150**	
		Semester Total		**24**			**21**	**650**									

MC (Mandatory Course): 1) Environmental Science, 2) Indian Constitution

Third Semester Electrical (Electronics & Power) Engineering
Course Code: SE101 (ESC)

Title of the Course: Engineering Mechanics

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Course Outcomes:
At the end of the course the student will will demonstrate the ability to
Understand the concepts of co-ordinate systems.

1. Analyze the three-dimensional motion.
2. Understand the concepts of rigid bodies.
3. Analyze the free-body diagrams of different arrangements.
4. Analyze torsional motion and bending moment.

Unit 1:
Introduction to vectors and tensors and co-ordinate systems (5 hours)
Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.
Three-dimensional Rotation (4 hours)
Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinatetransformation of vectors and tensors.

Unit 2: Kinematics of Rigid Body (6 hours)
Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two-and three dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.

Unit 3: Kinetics of Rigid Bodies (5 hours)
Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition andcomputation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Massmoment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia andPolar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.

Unit 4:
Free Body Diagram (1 hour)
Free body diagrams; Examples on modelling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.

General Motion (9 hours)
Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.

Unit 5:
Bending Moment (5 hours)
Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.
Torsional Motion (2 hours)
Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.
Friction (3 hours)
Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.

Text / References:
1. J. L. Meriam and L. G. Kraige, “Engineering Mechanics: Dynamics”, Wiley, 2011.
2. M. F. Beatty, “Principles of Engineering Mechanics”, Springer Science & Business Media, 1986.

Third Semester Electrical (Electronics & Power) Engineering
Course Code: SE102 (PCC)

Title of the Course: Electrical Circuit Analysis

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	2	6	4	3	10	10	80	100

Course Outcomes:
At the end of the course the student will be able to:
1. Make use of mesh and nodal analysis and apply network theorems for the analysis of electrical circuits.
2. Obtain the transient and steady-state response of electrical circuits
3. Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
4. Examine behavior of the network using Laplace transformation.
5. Determine different parameters of two port networks and their relationship.

Unit 1: Network Theorems (10 Hours)
Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

Unit 2: Solution of First and Second order networks (8 Hours)
Solution of first and second order differential equations for Series and parallel R- L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Unit 3: Sinusoidal steady state analysis (8 Hours)
Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

Unit 4: Electrical Circuit Analysis Using Laplace Transforms (8 Hours)
Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

Unit 5: Two Port Network and Network Functions (6 Hours)
Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text / References:

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.

Third Semester Electrical (Electronics & Power) Engineering
Course Code: SE106 (PCC)

Title of the Course: Electrical Circuit Analysis Laboratory

Course Scheme			Evaluation Scheme (Practical)		
Practical	Periods/week	Credits	TW	POE	Total
2	2	1	25	25	50

Course Outcomes:
At the end of the course the student will be able to:

1. Outline the schematic diagram for various experiments.
2. Select appropriate instruments/apparatus required for the experiments.
3. Identify the terminals/ports for measurement of parameter across or through the elements.
4. Compare theoretical calculations and experimental results of various theorems.
5. Understand DC analysis, Transient analysis and Frequency analysis of a given circuit depending on types of elements
6. Determine various parameters of two port network experimentally.

List of Laboratory Experiments/ Demonstrations: (Any Eight)

1) Verification of principle of superposition in A.C. circuits.
2) Verification of Thevenin theorem in A.C. circuits
3) Verification of Norton's Theorem in A.C. circuits
4) Verification of Reciprocity theorem in A.C. circuits.
5) Verification of Millmans' theorem.
6) Verification of Maximum power transfer in ac circuits
7) Verification of Tellegin's theorem for two networks of the same topology.
8) Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor)
9) Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit)
10) Determination of time response of R-L-C series circuit to a step D.C. voltage input
11) Determination of parameter of Two Port Network.
12) Determination of Resonance of R-L-C Parallel circuit
13) Determination of Resonance, Bandwidth and Q factor of R-L-C series circuit.

Third Semester Electrical (Electronics & Power) Engineering
Course Code :SE103 (PCC)

Title of the Course : Analog Electronic Circuits

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	0	2	5	4	3	10	10	80	100

Course Outcomes:
At the end of the course the student will be able to:

1. Describe the principle of operation and application of diode, BJT and FET.
2. Discuss performance of amplifiers and oscillators and analyze frequency response of different amplifiers and make use of MOSFET as a switch.
3. Understand the functioning of OP-AMP and design OP-AMP based circuits.
4. Analyze linear applications of Op-Amp.
5. Examine nonlinear applications of Op-Amp.

Unit 1: Diode and BJT circuits (10 Hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits, Structure and I- V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Unit 2: MOSFET circuits (8 Hours)

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Unit 3: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Unit 4: Linear applications of op-amp (8 Hours)

Idealized analysis of op-amp circuits. Inverting and non- inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.

Unit 5: Nonlinear applications of op-amp (6 Hours)

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Text/References:

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

Third Semester Electrical (Electronics & Power) Engineering
Course Code :SE107 (PCC)

Title of the Course : Analog Electronic Circuits Laboratory

Course Scheme			Evaluation Scheme (Practical)		
Practical	Periods/week	Credits	TW	POE	Total
2	2	1	25	25	50

Course Outcomes:
At the end of the course the student will be able to:

1. Evaluate the performance of p-n junction diode and zener diode.
2. Design and test various rectifiers used in electronics circuits.
3. Design, test and evaluate BJT amplifiers in CB configuration.
4. Design and test power amplifiers and oscillators in electronic circuits.
5. Determine performance parameters of operational amplifier.
6. Experiment with linear and non-linear applications of Op-Amp.

List of Laboratory Experiments/ Demonstrations: (Any Eight)

1) To study VI characteristics of p-n junction diode
2) To study VI characteristics of zener diode
3) To study half wave rectifier
4) To study full wave rectifier
5) To study bridge wave rectifier
6) To study input characteristics of common base configuration
7) To study power amplifier.
8) Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).
9) Design and set-up the RC-Phase shift Oscillator using FET, and calculate the frequency of output waveform.
10) Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation.(a) Hartley Oscillator (b) Colpitts Oscillator
11) Design and set-up the crystal oscillator and determine the frequency of oscillation.
12) To study op-amp as inverting and non-inverting amplifier using IC741.
13) To study op-amp as voltage follower
14) To study op-amp as an integrator using IC741.

Third Semester Electrical (Electronics & Power) Engineering
Course Code :SE104 (PCC)

Title of the Course : Electrical Machines-I

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	0	0	3	3	3	10	10	80	100

Course Outcomes:
At the end of this course, students will demonstrate the ability to

1. Understand the concept of magnetic circuits.
2. Understand the concept of electromagnetic circuit.
3. Understand the basic operation of DC machines.
4. Analyze the difference in operation of DC machines configuration.
5. Analyze the single phase and three phase transformer circuit.

Unit 1: Magnetic fields and magnetic circuits (6 Hours)

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Unit 2: Electromagnetic force and torque (9 Hours)

B-H curve of magnetic materials; flux- linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

Unit 3: DC machines (8 Hours)

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Unit 4: DC machine - motoring and generation (7 Hours)

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

Unit 5: Transformers (12 Hours)

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No- load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

Text / References

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
4. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010

Third Semester Electrical (Electronics & Power) Engineering
Course Code :SE108(PCC)

Title of the Course : Electrical Machines-I Laboratory

Course Scheme					**Examination Scheme** (Practical)				
Lecture	Tutorial	Practical	Periods/week	Credits	**Max. Marks TW**	**Max. Marks POE**	**Total Marks**	**Min. Passing Marks**	**Max. Marks**
0	0	2	2	1	25	25	50	25	50

Course Outcomes:
At the end of this course, students will demonstrate the ability to

1. Demonstrate the working principle of D.C. machines
2. Demonstrate the working principle three phase transformers.
3. Apply various speed control methods to D.C. machines.
4. Investigate the performance of D.C.
5. Estimate the performance parameters of transformer

List of Laboratory Experiments/ Demonstrations: (Any Eight)

1) Open Circuit and Short Circuit Test on 1 phase Transformers
2) Parallel operation of single phase transformers
3) Load test on single phase transformer
4) Open Circuit and Short Circuit Test on 3 phase Transformers
5) Scott Connection of Transformer
6) Magnetization Characteristics of separately excited DC Generator
7) Load Test on DC Shunt Generator
8) Load Test on DC Compound Generator
9) Starting of DC Shunt Motor
10) Load Test on DC Shunt Motor
11) Speed Control of DC Shunt Motor
12) Brake Test on DC Shunt Motor
13) Determine the efficiency of DC machine through Hopkinson’s test
14) O.C.C & Load characteristics of DC Shunt and DC Series generator
15) Study of 3 point and 4 point starter in DC machines.

Third Semester Electrical (Electronics & Power) Engineering
Course Code :SE105(PCC)

Title of the Course : Electromagnetic Fields

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Course Outcomes:

At the end of the course, students will demonstrate the ability

1) Derive the relationship between different types of coordinate systems
2) Apply Coulomb's law and Gauss' Law to different kinds of charge distribution in space
3) Solve electrostatic boundary-value problems by Poisson's and Laplace's equations.
4) Understand Biot-Savert's Law and Ampere's Law in magnetic field
5) Analyze time-varying electromagnetic field governed by Maxwell's equationsand propagation of EM wave through various media.

This course shall have Lectures and Tutorials. Most of the students find difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.

Unit 1: **Review of Vector Calculus (9 hours)**

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl: integral theorems of vectors, Conversion of a vector from one coordinate system to another.

Unit 2: Static Electric Field (9 Hours)

Coulomb's law, Electric field intensity, Electrical field due to point charges, Line, Surface and Volume charge distributions, Gauss law and its applications, Absolute Electric potential, potential difference, Calculation of potential differences for different configurations, Electric dipole, Electrostatic Energy and Energy density.

Unit 3: Conductors, Dielectrics and Capacitance (9 Hours)

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance,

Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations

Unit 4: Magnetic Forces, Materials and Inductance & Static Magnetic Fields (9 Hours)

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances. Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Unit 5: Time Varying Fields, Maxwell's Equations and Electromagnetic Waves (9 Hours)

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces, Boundary Conditions.

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Poynting theorem.

Text / References:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G.W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W.J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W.J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E.G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
Fourth Semester Electrical (Electronics & Power) Engineering

Course Category	Course Code	BoS	Course Title	Teaching Scheme: Hours per week L	T	P	No. of credits	Examination Scheme: THEORY Duration of paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional MSE	IE	Total	Min. Passing Marks	PRACTICAL Max Marks TW	Max Marks POE	Total	Min. Passing Marks
BSC	SE201	S&H	Mathematics-III (Probability and Statistics)	3	1	0	4	3	80	10	10	100	40	--	--	--	--
PCC	SE202	Electronics	Digital Electronics	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	SE203	Electrical	Electrical Machines – II	3	1	0	4	3	80	10	10	100	40	--	--	--	--
PCC	SE204	Electrical	Measurements and Instrumentation	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	SE205	Electronics	Signals & Systems	3	1	0	4	3	80	10	10	100	40	--	--	--	--
Laboratory																	
PCC	SE206	Electronics	Digital Electronics Laboratory	0	0	2	1	--	--	--	--	--	--	25	25	50	25
PCC	SE207	Electrical	Electrical Machines – II Laboratory	0	0	2	1	--	--	--	--	--	--	25	25	50	25
PCC	SE208	Electrical	Measurements and Instrumentation Laboratory	0	0	2	1	--	--	--	--	--	--	25	25	50	25
MC	SE209	S&H	Slot for MC	-	-	-	0	--	--	--	--	--	--				
		Total		**15**	**3**	**6**	**21**					**500**				**150**	
		Semester Total		**24**			**21**	**650**									

MC (Mandatory Course): 1) NSS, 2) Essence of Indian Knowledge Tradition

Fourth Semester Electrical (Electronics & Power) Engineering
Course Code: SE201 (BSC)
Title of the Course: Mathematics-III (Probability and Statistics)

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Course Outcomes:

At the end of the course, students will demonstrate the ability

1. Use discrete random variable, Poisson ratio, Barnaul's theorem to solve probability and statistical problems.
2. Use discrete and conditional probability including requirement mere and variance for making decision and organize, manage and present data, calculate probabilities and derive the marginal and conditional distribution of bivariate random variable.
3. Calculate and interpreted the correlation between two variables, demonstrate understanding of the theory of maximum likelihood estimation.
4. Explain how supply and demand related, relationship between the price of a product and the quantity of the same product.
5. Demonstrate that a sample size that is too small increases the likelihood of a type two error, skewing the results, will decreases the power of the study.

Unit 1: Basic Probability (12 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Unit 2:

Continuous Probability Distributions (4 hours)

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Bivariate Distributions (4 hours)

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Unit 3: Basic Statistics (8 hours)

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Unit 4: Applied Statistics (8 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Unit 5: Small samples (4 hours)

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text / References:

1. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, 2003.
3. S. Ross, “A First Course in Probability”, Pearson Education India, 2002.
4. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, Wiley, 1968.
5. N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.
6. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2000.
7. T. Veerarajan, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.

Fourth Semester Electrical (Electronics & Power) Engineering
Course Code : SE202 (PCC)

Title of the Course: Digital Electronics

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	0	2	5	4	3	10	10	80	100

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1) Understand working of logic families and logic gates.
2) Design and implement Combinational logic circuits.
3) Design and implement Sequential logic circuits.
4) Understand the process of Analog to Digital conversion and Digital to Analog conversion.
5) Be able to use PLDs to implement the given logical problem.

Unit 1: Fundamentals of Digital Systems and logic families (7Hours)

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

Unit 2: Combinational Digital Circuits (7Hours)

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Unit 3: Sequential circuits and systems (7Hours)

A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K-T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Unit 4: A/D and D/A Converters (7Hours)

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

Unit 5: Semiconductor memories and Programmable logic devices. (7Hours)

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016

Fourth Semester Electrical (Electronics & Power) Engineering
Course Code : SE206 (PCC)

Title of the Course: Digital Electronics Laboratory

Course Scheme			Evaluation Scheme (Practical)		
Practical	Periods/week	Credits	TW	POE	Total
2	2	1	25	25	50

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1) Distinguish between analog and digital systems and identify the various digital ICs and understand their operation.
2) Apply Boolean laws to simplify the digital circuits.
3) Understand, analyze, design and validate various combinational and sequential circuits.
4) Identify basic requirements for a design application and propose a cost effective solution.
5) Identify and prevent various hazards and timing problems in a digital design.
6) To develop skill to build, and troubleshoot digital circuits.

List of Laboratory Experiments/ Demonstrations (Any Eight)

1) Introduction to Digital Laboratory Equipments& IC‟s
2) To study basic gates and verify their truth tables
3) Implementation of the Boolean function using logic gates in both SOP and POS forms.
4) To design and construct basic flip-flops
5) To design and implement encoder
6) To design and implement decoder
7) To Design & Verify the Operation of Magnitude Comparator
8) To design and implement multiplexer
9) To design and implement demultiplexer
10) To Design adder, subtractor circuit using a 4-bit adder IC
11) To realize Basic gates (AND,OR,NOT) From Universal Gates(NAND & NOR)
12) Verification of State Tables of RS, JK,T and D Flip-Flops using NAND Gates
13) To study about full adder & verify its truth table.
14) Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers.
15) Design and Verify the 4-Bit Synchronous Counter
16) Design and Verify the 4-Bit Asynchronous Counter.

Fourth Semester Electrical (Electronics & Power) Engineering
Course Code: SE203 (PCC)

Title of the Course: Electrical Machines-II

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Course Outcomes:
At the end of this course, students will demonstrate the ability to

1) Understand the concepts of rotating magnetic field.
2) Understand the operation of pulsating and revolving magnetic fields.
3) Analyze the principle of operation & performance characteristics of the induction motor.
4) Explain principle of operation of single phase induction motor.
5) Analyze the principle of operation & performance characteristics of synchronous machine

Unit 1: Fundamentals of AC machine windings (8 Hours)

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding-concentrated and distributed, sinusoidally distributed winding, winding distribution factor

Unit 2: Pulsating and revolving magnetic fields (4 Hours)

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Unit 3: Induction Machines (12 Hours)

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Losses and Efficiency, Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency), Methods of starting, braking and speed control for induction motors, Generator operation, Self-excitation, Doubly-Fed Induction Machines.

Unit 4: Single-phase induction motors (6 Hours)

Constructional features, double revolving field theory, equivalent circuit, determination of parameters, Split-phase starting methods and applications

Unit 5: Synchronous machines (10 Hours)

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation, Operating characteristics of synchronous machines, V-curves, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics, Parallel operation of alternators - synchronization and load division.

Text/References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.
5. A. S. Langsdorf, “Alternating current machines”, McGraw Hill Education, 1984.
6. P. C. Sen, “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007.

Fourth Semester Electrical (Electronics & Power) Engineering

Course Code :SE207 (PCC)

Title of the Course : Electrical Machines-II Laboratory

Course Scheme					**Examination Scheme** (Practical)				
Lecture	Tutorial	Practical	Periods/week	Credits	**Max. Marks TW**	**Max. Marks POE**	**Total Marks**	**Min. Passing Marks**	**Max. Marks**

0	0	2	2	1	25	25	50	25	50

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Demonstrate the use of various starters for three phase induction motors.
2. Interpret the regulation and efficiency of induction machine at various loads
3. Identify different parts of synchronous machines.
4. Interpret the regulation and efficiency of synchronous machine at various loads.
5. Make use of special motors for various applications**.**

List of Laboratory Experiments/ Demonstrations:

1) Study of DOL starter of Three Phase Induction Motor
2) Study of Auto-transformer Starter
3) Study of Automatic Star Delta of Three Phase Induction Motor
4) Speed Control of Three Phase Induction Motor with Pole Changing Method
5) No load and Blocked rotor Test of three phase squirrel cage Induction Motor
6) Brake test on slip ring Induction Motor.
7) To Study the Load Test on a Three-Phase Induction Motor
8) Regulation of Three Phase Alternator with Direct Loading Method
9) Regulation of Three Phase Alternator with OC, SC test
10) Regulation of Alternator with Potier Triangle
11) Plot V and inverted V of Synchronous motor.
12) To Determine the Ratio Xq/Xd for Three-Phase Alternator by using “Slip Test”
13) To Study the Synchronization of an Alternator with an Infinite Bus by “Dark Lamp Method”
14) To Determine Potier Reactance of Three-Phase Alternator by “Zero Power Factor Lagging Saturation Curve”
15) To Determine Negative Sequence and Zero Sequence Reactances of Synchronous Generator
16) To Study the Characteristics of Three-Phase Induction Generator
17) To Determine Direct Axis Subtransient (Xd”), Quadrature Axis Subtransient (Xq”) Reactances of Synchronous Machine.

Fourth Semester Electrical (Electronics & Power) Engineering

Course Code :SE204 (PCC)

Title of the Course : Measurements and Instrumentation

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total

3	0	2	5	4	3	10	10	80	100

Course Outcomes:

At the end of this course, the ability students will demonstrate to

1) Classify different types of measuring instruments on the basis of principle of operation
2) Measure various electrical and physical quantities using transducers
3) Apply different methods to measure power and energy
4) Compute resistances, inductance and capacitance using different methods

Unit 1: Measuring Instruments (09 Hours)

Classification, deflecting, controlling, damping torques, Basic principles of operation of Ammeter & Voltmeter, PMMC, Moving Iron, and Electrodynamometer type instruments, Principle of operation, Torque Equation, Errors, merits & demerits of each type, Analog & Digital instruments, Advantages of digital instruments, Absolute & secondary Instruments, Indicating & Recording type instruments, Shunt & Multiplier

Unit 2: Generalized Instrumentation System (09 Hours)

General block diagram of instrumentation system, Active and passive transducers, Strain Gauges, Resistive, Inductive & Capacitive Transducers, Transducers for measurement of Displacement, Velocity, Force, & Torque, Static and dynamic characteristics and performances of instruments, Statistical treatment of measurement errors, Gaussian error distribution, probability tables, combination of errors

Unit 3: Measurement of Power & Energy (09 Hours)

Measurement of active & reactive power in single & three phase circuits, using dynamometer type instruments, Errors in Power Measurement, Measurement of Energy in single & three phase circuits using indication type instruments, Errors in energy measurements, Maximum Demand Indicator.

Unit 4: Measurement of Circuit Parameters (09 Hours)

Measurement of low resistance by Kelvin's Double Bridge, Measurement of Medium Resistance by Wheatstone bridge, Measurement of high resistance by loss of charge method, Earth Resistance Tester, Measurement of Inductance & Capacitance: General theory of AC bridges, study of Maxwell, De-sauty's&Schering Bridges, detectors of AC bridges.

Unit 5: Miscellaneous Measurements (09 Hours)

Temperature Measurement: Laws of thermo-electric circuits, thermocouples, thermistors, optical pyrometers, temperature compensation of temperature sensors. Pressure measurement: Manometer, Bellows, Bourdon tube, Diaphragms, Power factor & Frequency Measurement, General Theory of Instrument Transformer, extension of range using CT &PT and its applications

Recommended Books

1. Electrical Measurement & Measuring Instruments by Golding
2. Instrumentation Devices and Systems by Rangan
3. Electronic Instrumentation & Measurement Technique by W.D. Cooper
4. Electrical and Electronics Measurement & Instrumentation by A.K. Sawhney.

Fourth Semester Electrical (Electronics & Power) Engineering

Course Code :SE208 (PCC)

Title of the Course : Measurements and Instrumentation Laboratory

Course Scheme					**Examination Scheme** (Practical)				
Lecture	Tutorial	Practical	Periods/week	Credits	**Max. Marks TW**	**Max. Marks POE**	**Total Marks**	**Min. Passing Marks**	**Max. Marks**
0	0	2	2	1	25	25	50	25	50

Course Outcomes:

At the end of this course, the ability students will demonstrate to

1) Acquire hand on experience about different measurement devices and its working principles.
2) Acquire knowledge of principle of calibration of a measuring instrument and plotting of calibration curves.
3) Acquire hand on experience and knowledge on working of Kelvin's double bridge and wheat stone's bridge, AC bridges, CT/PT,
4) Analyze features of oscilloscope and different types of oscilloscopes
5) Analyze the performance characteristics of temperature transducer like Thermocouple, Thermistor and RTD.

List of Laboratory Experiments/ Demonstrations: (Any Eight)

1) Measurement of a batch of resistors and estimating statistical parameters.
2) Measurement of L using a bridge technique as well as LCR meter.
3) Measurement of C using a bridge technique as well as LCR meter.
4) Measurement of Low Resistance using Kelvin's double bridge.
5) Measurement of High resistance and Insulation resistance using Meggar.
6) Usage of DSO for steady state periodic waveforms produced by a function generator. Selection of trigger source and trigger level, selection of time-scale and voltage scale. Bandwidth of measurement and sampling rate.
7) Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.
8) Usage of DSO to capture transients like a step change in R-L-C circuit.
9) Current Measurement using Shunt, CT, and Hall Sensor.
10) Measurement of strain using strain gauge.
11) Measurement of level using capacitive transducer.
12) Study of distance measurement using ultrasonic transducer.
13) To determine output characteristics of LVDT and measure displacement using LVDT.
14) To study characteristics of temperature transducer like Thermocouple, Thermistor and RTD.
15) To study differential pressure transducer & signal conditioning of output signal.

Fourth Semester Electrical (Electronics & Power) Engineering
Course Code: SE205 (PCC)

Title of the Course: Signals and Systems

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
2	1	0	3	3	3	10	10	80	100

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1) Classify different types of signals and systems and understand various system properties
2) Analyze behavior of continuous and discrete-time LTI systems
3) Discuss Fourier, Laplace & Z transform analysis for continuous & discrete type systems
4) Analyze systems in complex frequency domain.
5) Understand sampling theorem and its implications.

Unit 1: Introduction to Signals and Systems (9 hours)

Signals and systems as seen in everyday life, and in various branches of engineering and science, Signal properties: periodicity, absolute integrability, determinism and stochastic character, Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time- limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity, additivity and homogeneity, shift-invariance, causality, stability, realizability, Examples.

Unit 2: Behaviour of continuous and discrete-time LTI systems (9 hours)

Impulse response and step response, convolution, input-output behaviour with a periodic convergent inputs, cascade interconnections, Characterization of causality and stability of LTI systems, System representation through differential equations and difference equations, State-space Representation of systems, State-Space Analysis, Multi-input, multi-output representation, State Transition Matrix and its role, Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

Unit 3: Fourier Transforms (9 hours)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients, Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality, The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT), Parseval's Theorem.

Unit 4: Laplace and z- Transforms (9 hours)

Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behaviour, the z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Unit 5: Sampling and Reconstruction (9 hours)

The Sampling Theorem and its implications, Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects, Relation between continuous and discrete time systems, Introduction to the applications of signal and system theory, modulation for communication, filtering, feedback control systems.

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
6. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
7. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.