Course of Study
S. Y. B. Tech. (Electrical Engineering)
(Effective from Academic Year 2019-20)

Department of Electrical Engineering,
SGGS Institute of Engineering and Technology, Vishnupuri,
Nanded-431606 (MS), India
(An Autonomous Institute of Government of Maharashtra)

Program Outcomes (POs)

After completing the Electrical Engineering course the students will be able to -

1. Apply knowledge of science, mathematics, and engineering fundamentals for solving complex engineering problems culminating in a major design project incorporating realistic engineering constraints.
2. Gain advanced, specialized practical knowledge and apply skills in diversified areas viz. Electrical Machines, Electromagnetic fields, Power Systems, Power Electronics and drives, Renewable Energy Technologies, Digital Signal Processing, Control Systems, High Voltage Engineering.
3. Understand and use different software tools viz. MI-Power, ETAP, Multisim, MATLAB in the domain of circuit, field, power system, control system simulations.
4. Design and perform experiments for analysis, interpretation and synthesis of experimental data in order to draw valid conclusions.
5. Function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty by means of effective communication in writing as well as through public speaking.
6. Apply engineering design to produce solutions in order to meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.
7. Communicate effectively in complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
10. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Program Educational Objectives (PEOs)

Engineering Graduates will be able to:

1. Excel in growing careers involving design, development of electrical / electronic systems by working in the diversified sectors of the industry, government organizations, public sector and multinational corporations and/or pursue higher education at various reputed institutes.
2. Make considerable progress in their chosen domain of interest and will build up additional technical expertise to remain globally competitive.
3. Be able to demonstrate inter-personal skills, professional and personal leadership and growth with commitment to ethical and social responsibilities.

Correlation between the PEOs and the POs

PO/PSO ➡ ⬇ PEO	a	b	c	d	e	f	g	h	i	J
I	✓	✓				✓	✓			
II		✓	✓	✓		✓		✓	✓	
III				✓	✓	✓	✓			✓

SGGS Institute of Engineering and Technology, Vishnupuri, Nanded
Department of Electrical Engineering
S. Y. B. Tech.
STRUCTURE
Effective from Academic Year 2019-20

Semester I						
Course Code	**Name of the course**	**L**	**T**	**P**	**Credits**	
					Th	**Pr**
BSC272	Mathematics-III: Numerical Methods and Differential Equations	3	--	--	3	--
PCC-EE201	Analog Electronic Circuits	3	--	2	3	1
PCC-EE202	Electrical Machines-I	3	--	2	3	1
PCC-EE203	Circuit Theory	3	--	2	3	1
PCC-EE204	Electromagnetic Fields	3	1	--	4	--
LAB-EE205	Computer Application in Electrical Engineering	--	--	2	--	1
BSC261	Mathematical Foundation for Engineering*	2	--	--	Audit	
MAC277	Indian Constitution	2	--	--	Audit	
	Total	**19**	**1**	**8**	**20**	
Semester II						
Course Code	**Name of the course**	**L**	**T**	**P**	**Credits**	
					Th	**Pr**
BSC275	Mathematics-IV: Statistical Methods and Complex Analysis	3	--	--	3	--
PCC-EE206	Electrical Machines-II	3	--	2	3	1
PCC-EE207	Digital Electronics and Logic Design	3	--	2	3	1
PCC-EE208	Electrical and Electronics Measurements	3	--	2	3	1
PCC-EE209	Signals and Systems	3	--	--	3	--
HMC278	Human Values and Professional Ethics	2	--	--	2	--
	Total	**17**	**--**	**6**	**20**	

L – No. of Lecture Hours/week, T – No. of Tutorial Hours/week, P – No. of Practical Hours/week
* This Audit course is only for Direct Second Year students and a MANDATORY course.

Attendance Criteria: Students have to maintain 75% attendance in all the registered courses in a semester to be eligible for appearing examinations.

Institute Open Elective Course (SEM-I)
BSC 771: Mathematical Foundation for Engineering

Examination Scheme for Theory Credit Courses
In Semester Evaluation : 20 Marks
Mid Semester Examination : 30 Marks
End Semester Examination : 50 marks

SEMESTER-I

Mathematics–III: Numerical Methods and Differential Equations

Course Code	BSC272			
Category	Basic Science Course			
Course title	Numerical Methods and Partial Differential Equations			
Scheme and Credits	L	T	P	Credits
	3	0	0	3

Course Objectives:

1. To understand Number representation and errors. Locating roots of polynomial and transcendental equations.
2. To understand the interpolation and approximation, Numerical differentiation and numerical integration.
3. To learn various numerical techniques to solve differential equations.
4. To understand the concepts of Fourier series
5. To understand the methods of solving partial differential equations such as wave equation, heat equation and Laplace equation.

Course Outcomes:

On successful completion of this course students will be able to
1. Develop the numerical skills for error analysis
2. Find roots of polynomial and transcendental equations using numerical techniques
3. Evaluate numerical integration and differentiation.
4. To use numerical methods to solve ordinary and partial differential equations and other engineering problems.
5. Develop the skills of solving Partial differential equations using separation of variables and Fourier series.

Course Articulation Matrix:

PO → / CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3		2								2
CO2	3	3		2								2
CO3	3	3										2
CO4	3	3	1	2								2
CO5	3	3	1	2								2

Syllabus:

Unit 1: Numerical Methods – 1 (12 hours)

Round-off Error, Truncation Error, Errors in Scientific and Engineering Computation, Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Fals, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit 2: Numerical Methods – 2 (18 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution to two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods).

Unit 3: Fourier series (07 hours)

Expansion of a function in Fourier series for a given range - Half range sine and cosine expansions.

Unit 4: Partial Differential Equations (08 hours)

Separation of variables, first and second order one dimensional wave equation, heat equation and two dimensional Laplace equation.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Fifth Edition, Narosa Publishing House, 2016.
3. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.
4. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, 7th Edition, McGraw Hill
5. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI learning Pvt. Ltd.
6. B.S. Grewal, Numerical Methods in Engineering & Science, Khanna Publication, Ed. 9th

PCC-EE201 Analog Electronic Circuits

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	-	2	3	1	4

Prerequisite:

1. Knowledge of Semiconductor Physics
2. Knowledge of Basic Electrical Engineering

Course objectives:

1. To understand operation of semiconductor devices viz. diodes, MOSFET, BJT, and operational amplifier.
2. To understand DC analysis and AC models of semiconductor devices.
3. To apply concepts for the design of regulators, amplifiers and oscillators.
4. To verify the theoretical concepts through laboratory and simulation experiments.
5. To implement mini projects based on concept of electronics circuit concepts.

Course outcomes:

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

1. Understand the current voltage characteristics of semiconductor devices.
2. Develop the ability to analyze and design analog electronic circuits viz. rectifier, amplifier, oscillator, regulator circuits using discrete components.
3. Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation..
4. Evaluate frequency response to understand behavior of electronic circuits.
5. Understand the functioning of OP-AMP and design OP-AMP based circuits
6. Take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.

Course Articulation Matrix:

PO ➡ / ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	3	1	3	1	1	1	-	-	-
CO2	3	1	1	3	1	2	1	-	-	-
CO3	2	2	2	1	1	3	2	-	-	-
CO4	2	2	2	1	1	1	2	-	-	-
CO5	1	1	3	1	1	1	1	-	-	-
CO6	1	2	1	3	1	1	1	-	-	-
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit1: Diode circuits (4 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.

Unit2: BJT circuits (8 Hours)
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.

Unit3: 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 4: 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 5: Linear applications of op-amp (6 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).

Unit6: Nonlinear applications of op-amp (6 Hours)
Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators.
Precision rectifier, peak detector.

Text/Reference Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Eighth edition, PHI publishers, 2004.
2. J. Millman and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw-Hill Publishing Company, 1988.
3. R.A. Gayakwad, Op-Amps & Linear Integrated Circuits, PHI, Fourth Edition, 2012
4. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
5. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.

Term work:
It will consist of a record of at least eight experiments from the following list based on the prescribed syllabus.

1. I-V Characteristics of Diode, BJT and MOSFET.
2. Measurement of op-amp parameters and comparison with op-amp data sheets.
3. Assembling of op-amp inverting, non-inverting and differential circuit to measure an input in the range of mill volts to few volts.
4. Transistor amplifiers: frequency response of BJT, multistage BJT amplifier and FET amplifier.
5. Op-amp as square, sine and triangular wave generator.
6. Op-amp as ZCD, Comparator and Schmitt trigger.
7. Study of active filters- Low pass and high pass filters.

Continuous Evaluation of Practical's:
Continuous Evaluation of Practical's performed per week will be carried on weekly basis till the end of semester and assessment will be done according to it.

PCC-EE202 Electrical Machines-I

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	-	2	3	1	4

Prerequisite:

1. Fundamentals of Electrical Engineering.
2. Basics of Electromagnetism.

Course objective:

1. Introduce basic fundamentals of different electrical machines and transformers.
2. Introduce the characteristics of different D.C. machines
3. Analysis and investigation of the major performance characteristics of different types of motors.
4. Investigation of motors' starting problems.
5. Allow the students to gain the proficiency to differentiate between the different types of motors, with the capability to select the proper motor for the proper application.
6. Provide the students with the proficiency to conduct and benefit from the testing procedures of electric motors with the ability to analyse data and to obtain the major characteristics.

Course outcome:

Upon successful completion of this course, a student should be able to:

1. Design and conduct experiments as well as analyse the parameter of DC machine & transformer.
2. Develop understanding of professional & ethical responsibility of DC machine & transformer.

3. Find out specific rating of Transformer & DC machines for installation as per requirement.
4. Analysis of different operating parameters under load and no load condition.
5. Detection and diagnosis of fault.
6. Get information about proper application of machines.

Course Articulation Matrix:

PO ➡ / ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	1	1	3	1	2	1	1	1	1
CO2	2	1	1	2	1	3	1	3	1	2
CO3	2	2	1	3	1	3	1	2	1	2
CO4	3	1	2	2	2	2	1	1	1	1
CO5	1	2	3	2	2	3	2	1	3	2
CO6	2	2	2	3	1	2	2	2	2	1
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit 1: Single Phase Transformer (8 Hours)

Transformer construction and practical consideration, Transformer reactance's and equivalent circuits, Engineering aspects of transformer analysis, effect of load on power factor, phasor diagrams, per unit quantities, Excitation phenomenon in transformers-Switching transients, Testing-Polarity test, Open Circuit Test (O.C.) Short Circuit Test (S.C.), Sumpner's Test, Variable frequency transformer, Instrument Transformer-Current transformer, Potential transformer, Pulse transformer and applications.

Unit 2: Three Phase Transformers (6 Hours)

Special constructional features, three phase transformers connections, Labelling of transformers Terminals, Star/Star connection, Delta/Delta Connection, Star/Delta, Delta/Star connection, Delta/Zigzag Star, Star/Zigzag Star, Phase groups, Choice of transformers connections, Harmonics, Parallel operation of transformers, Three winding transformers and its equivalent circuits, Stabilization by Tertiary winding, Phase conversion/Open Delta connection, Three/Two phase conversion (Scott connection), Three/Six conversion, Three/One conversion, On-Off Load Tap changing transformers, cooling methodology, Types and Routing tests according to ISI.

Unit 3: Electromechanical Energy Conversion Principles (6 Hours)

Forces and torques in magnetic field systems Energy balance, Energy in Singly-Excited magnetic field systems, Determination of magnetic force and torque from energy, Determination of magnetic force and torque from co-energy, Multiply-Excited magnetic field systems, Forces and torques in systems with permanent magnets, Energy Conversion via electrical field, Electrified energy, Dynamic equations of electromechanical systems and Analytical Techniques.

Unit 4: DC Generators (8 Hours)

Construction of armature and field systems, Basic Principle of working, Emf equation, Types, armature windings, Characteristics and applications of different types of DC Generators, Building of emf in DC Shunt Generator and causes of failure, Armature reaction-Demagnetizing and Cross magnetizing mmf's and their estimations; Remedies to overcome the armature reaction; Commutation Process, Straight line commutation, Commutation with variable current density, under and over commutation, Causes of bad commutation and remedies; inter-poles, Compensating windings.

Unit 5: D.C. Motors (6 Hours)

Principles of working, Significance of Back emf, Torque Equation, Types, methods of excitation-Steady State Motor Circuit equation, Characteristics and Selection of DC Motors for various applications, Starting of DC Motors, Speed Control of DC Shunt and Series Motors, Braking of DC Motors- Plugging, Dynamic Braking, Regenerative Braking; Losses and Efficiency, Condition for Maximum Efficiency, Effect of saturation and armature reaction on losses; Permanent Magnet DC Motors, Types and Routing tests according to ISI Specifications.

Unit 6: Variable-Reluctance Machines and Stepping Motors (6 Hours)

Basic VRM Analysis, Practical VRM analysis, Current waveform for torque production, Non-Linear Analysis, Stepping Motors.

Text/Reference Books :

1. B. L. Theraja, A.K. Theraja, A Textbook of Electrical Technology, Vol-II, S. Chand& Co., New Delhi,2005.
2. I J Nagrath, D P Kothari; "Electric Machines," Tata McGraw Hill Publication. Second Edition (Reprint) 2003.
3. A. E. Fitzgerald, C. Kingsley, S. D. Umans. "Electrical Machinery" Tata McGraw Hill. Sixth Edition2002.
4. Nasser Syed. A "Electrical Machines and Transformers," New York, Macmillon 1984.
5. Langsdorf "DC Machines".
6. J. B. Gupta, "Electrical Machines", SK Kataria and Sons, New Delhi
7.S K Bhattacharya, "Electrical Machines", Tata McGraw Hill, New Delhi.

Term work:

It will consist of a record of at least eight of the following experiments based on the prescribed syllabus.

1. To perform open circuit and short circuit test on single phase transformer to find its core loss, full load copper loss and constants of its equivalent circuit.
2. To operate two single-phase transformers in parallel and how they share a load under various Conditions of their voltage ratios and leakage impedances.
3. To study V-connection of identical single-phase transformers for obtaining three phase transformation.
4. To study Scott-connection of single-phase transformer.
5. Performance of Sumpner's Test.
6. Study of no load current waveform of single-phase transformer.
7. Determination of magnetization, external and internal characteristics of a D.C. shunt generator,

8. Speed variation of a D.C. Shunt machine by- (i) armature voltage control & (ii) field current control method.
9. To study the performances of a D.C. shunt motor by Load/ Brake test.
10. To find efficiency of a D.C. shunt / compound machine by performing Swinburn's test.
11. To separate the losses in a D.C. shunt machines by performing the Retardation test.
12. Field test on two identical series machines to separate various losses and determine the efficiency of machines.
13. Performance of Hopkinson's Test.
14. Study of traditional and modern starters for DC motors

Continuous Evaluation of Practical's:
Continuous Evaluation of Practical's performed per week will be carried on weekly basis till the end of semester and assessment will be done according to it.

PCC-EE203 Circuit Theory

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	-	2	3	1	4

Prerequisite:
1. Knowledge of Basic Electrical Engineering
2. Knowledge of Complex Number
3. Knowledge of Matrices.

Course objectives:
1. To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems.
2. To develop an understanding of the fundamental laws and elements of electric circuits.
3. To understand waveforms, signals, and transient, and steady-state responses of RLC circuits.
4. To develop the ability to apply circuit analysis to DC and AC circuits.
5. To understand advanced mathematical methods such as Laplace and Fourier transforms along with linear algebra and differential equations techniques for solving problems.

Course outcomes:
1. To remember basic concepts and principles of electrical circuits.
2. To explain network theorems and their applications.
3. To solve network problems using mesh current and node voltage equations.
4. To investigate initial conditions and obtain circuit response using Laplace Transform.
5. To evaluate network functions and two port parameters for electrical networks.
6. To analyse electrical circuits using network theorems.

Course Articulation Matrix:

PO ➡ / ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	2	2	3	2	2	1	2	2
CO2	2	2	3	2	3	3	2	1	2	2
CO3	2	2	2	3	1	1	-	-	-	-

CO4	2	1	2	2	1	2	2	2	1	1
CO5	2	2	2	3	2	2	1	2	2	2
CO6	2	2	3	3	2	3	1	1	1	1
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit 1: Development of Circuit Concepts (06 Hours)
Charge, current, voltage, energy, introduction to basic passive circuit parameters. Reference direction for current and voltage, active element convention, source transformation, dot convention for coupled circuits, Topological description of networks.

Unit 2: Network equations (06 Hours)
Kirchoff's laws, number of network equations, loop variable analysis, node variable analysis, duality, formation of network equation in matrix form, Use and study of initial conditions in various elements, a procedure for evaluating initial conditions. Solution of network equations by Laplace Transformation technique.

Unit 3: Transform of other signal waveform (06 Hours)
Shifted unit step function, ramp and impulse function, waveform synthesis, initial and final value theorem, convolution integral, convolution as a summation.

Unit 4: Impedance functions and network theorems (08 Hours)
Concept of complex frequency, transform impedance and transform circuits, series and parallel combination of elements, Thevenin's, Superposition, Millman's, Tellegen's, Reciprocity, Norton and Maximum power transfer theorems. Sinusoidal steady-state analysis.

Unit 5: Network functions (08 Hours)
Network functions for one port and two-port network, calculation of network functions, Ladder networks, general networks. Poles and zeros of network functions, restriction on poles and zeros locations for driving point functions and transfer functions, Time domain behavior from pole and zero plot**.**

Unit 6: Two-port parameters (06 Hours)
Relationship of two port variables, short circuit admittance parameters, opens circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets, and parallel connection of two port networks.

Term Work:
Term work shall consist of minimum eight experiments from the list given below
1. Verification of Maximum power transfer theorem.
2. Verification of Thevenin's theorem.
3. Verification of Superposition theorem.
4. Plotting of behavior of RC circuit for step input.
5. Plotting of behavior of RL circuit for step input.
6. Plotting of behavior of RLC circuit for step input.
7. Determination of hybrid and impedance parameters of a given network.
8. Sinusoidal study of RC and RL series networks.

Continuous Evaluation of Practical's:
Continuous Evaluation of Practical's performed per week will be carried on weekly basis till the end of semester and assessment will be done according to it.

Reference Books:
1. M. E. Van Valkenberg, Networtk analysis, Third Edition, Prentice Hall of India Publication, 1996.
2. C. P. Kuriakose, Circuit Theory: Continuous and Discrete Time Systems, Elements of Network Synthesis, Prentice Hall of India Publication, New Delhi, 2005.
3. L. P. Huelsman, Basic Circuit Theory, Third Edition, Prentice Hall of India, New Delhi, 2002.
4. W. H. Hayt. Jr. and J. E. Kemmerly, Engineering Circuit Analysis, Fifth Edition, Tata-McGraw Hill Edition, 2000

PCC-EE204 Electromagnetic Fields

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	1	-	4	0	4

Prerequisite: Vector Algebra

Course objectives:
1. Understanding of basic concepts of Vectors.
2. Understanding of basic concepts of Electrostatic fields and Electromagnetic fields.
3. Study of Magnetic Forces Materials and Devices
4. Study of Magneto Static Fields
5. Study of Maxwell's Equations

Course Outcomes: Students' will be able to:
1. Understand the applications of vector algebra
2. Learn basic theory of electric and magnetic fields
3. Evaluate the Electrostatic boundary value conditions and problems
4. Analyse various aspects of magneto static fields
5. Understand magnetic forces materials and devices.
6. Apply Maxwell's equations.

Course Articulation Matrix:

PO ➡ / ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	1	1	1	1	2	2	1	2
CO2	3	2	2	2	1	1	1	-	-	2
CO3	3	2	2	2	1	2	1	-	-	-
CO4	2	3	1	3	1	1	1	-	-	-
CO5	2	2	3	1	2	1	1	-	-	-
CO6	3	2	1	1	1	1	1	-	-	-
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit 1 Vector analysis: (06 Hours)

Vector Algebra, Rectangular Coordinate System, Vector Component, Vector Field, Dot Product, Cross Product, Circular and Cylindrical Coordinate System, Vector Calculus, Del Operator, Gradient of Scalar, Divergence of Vector and Divergence Theorem, Curl of a Vector and Stroke's Theorem, Lapalcian of a Scalar, Classification of Vector Fields.

Unit 2 Electrostatic Fields and Electric Fields: (08 Hours)

Gauss's Law- Maxwell's Equation, Electric Potential, Relationship between E and V-Maxwell's Equation, Electric Dipole and Flux Lines, Energy Density in Electrostatic Fields, Properties of Materials, Convection and Conduction Current, Conductors, Polarization in Dielectrics, Dielectric Constant and Strength, Linear , Isotropic and Homogenous Dielectrics, Continuity Equation and Relaxation Time, Boundary Conditions.

Unit 3 Electrostatic Boundary-Value Problems: (06 Hours)

Introduction, Poisson's and Laplace's Equations, Uniqueness Theorem, General Procedures for Solving Poisson's and Laplace's Equations, Resistance and Capacitance, Method of Images

Unit 4 Magneto Static Fields: (06 Hours)

Biot- Savart's Law, Ampere's Circuital Law-Maxwell's Equation, Application of Ampere's Law, Magnetic Flux Density-Maxwell's Equation, Maxwell's Equation for Static Fields, Magnetic Scalar and Vector Potentials.

Unit 5 Magnetic Forces Materials and Devices: (08 Hours)

Introduction, Forces due to Magnetic Fields, Magnetic Torque and Moment, Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits, Force on Magnetic Materials

Unit 6 Maxwell's Equations: (06 Hours)

Introduction, Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time Harmonic Fields.

Text Books:

1. William H. Hayt, Jr John A Buck, "Electromagnetic Engineering", Tata McGraw Hill, 6th Edition.
2. Shevgaonkar R.K., "Electromagnetic Waves", Tata McGraw Hill, 1st Edition.

Reference Books:

1. M. Sadiku, "Elements of Electromagnetics", oxford university press (2010), 4th Edition.
2. Paul, Clayton, "Introduction to Electromagnetic Fields", Tata McGraw Hill (2007), 3rd Edition.
3. Ashutosh Pramanik "Electromagnetic Theory and Applications", PHI Ltd 2nd Edition

LAB-EE205 Computer Application in Electrical Engineering (CAEE)

L	T	P	Credits(Th)	Credits(P)	Total Credits
-	-	2	0	1	1

Prerequisite:

1. Minimum knowledge of basic computer programming.

Course objectives:

1. To study the Simulink toolboxes and special toolboxes.
2. To get acquainted with software Programming related to Electrical and Electronics domain.
3. To analyze the existing Electrical and Electronics domain systems.
4. To research with the help of software's for modernization of existing Electrical and Electronics systems.

Course Outcomes: After completion of course students will be able to:

1. Simulate different engineering systems.
2. Use software's such as MI-Power, Sci- Lab, ETAP, Proteus, P-spice, PV Syst etc.
3. Execute programing Software's for analysis of different Electrical and Electronics domain systems.
4. Research with the help of simulation toolboxes for modernization of existing Electrical and Electronics systems.

Course Articulation Matrix:

PO ➡ / ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	2	3	3	2	2	2	1	-	-
CO2	2	2	3	3	3	3	2	2	2	1
CO3	2	2	3	2	3	2	2	1	1	1
CO4	3	2	3	2	1	1	1	1	2	2
(3) High, **(2)** Medium, **(1)** Low										

List of Experiments

Minimum ten experiments to be performed from

1. Three MATLAB experiments using Control System Toolbox.
2. Three programming experiments using SCI-Lab.
3. Four experiments using Power System Toolbox, MI-Power and ETAP.
4. Four experiment on circuit analysis using P-spice software, Proteus, NG-Spice.

Continuous Evaluation of Practical's:

Continuous Evaluation of Practical's performed per week will be carried on weekly basis till the end of semester and assessment will be done according to it.

MAC–277 Indian Constitution

L	T	P	Credits(Th)	Credits(P)	Total Credits
2	-	-	-	-	Audit Pass (AP)

Course Objectives:

1. To understand the basic foundation and the basic law for the governance of our nation, the history and the different types of Constitutions.
2. To understanding the importance and the different aspects of the Constitution. To know and understand the different rights enshrined in the Constitution and understand the rights and duties of the government.
3. To understand the basis and procedure of amendments.
4. To know the different aspects of the Union and the State Executive.
5. To know how our country was founded, who founded it, what are our rights are, what life was like, how life has changed, how the rights still apply today.

Course Outcomes:

1. Student will be able to understand how India has come up with a Constitution which is the combination of the positive aspects of other Constitutions.
2. Student will be able to understand the interpretation of the Preamble.
3. Student will be able to understand the basics of governance of our nation.
4. It helps in understanding the different aspects covered under the different important Articles.
5. Student will be able to understand the basic law and its interpretation. Understand the important amendments which took place and their effects.
6. Student will be able to understand our Union and State Executive better.
7. Student will be able to that along with enjoying the rights one needs to fulfill one's duties.

Syllabus:

1. Meaning of the constitution law and constitutionalism. Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights. The scheme of the Fundamental Duties and its legal status.
3. The Directive Principles of State Policy –Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and States.
4. Parliamentary form of Government in India. The constitution powers and status of the President of India.

5. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
6. Emergency Provisions: National Emergency, President Rule, Financial Emergency.
7. Local Self Government – Constitutional Scheme in India.
8. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19. Scope of the Right to Life and Personal Liberty under Article 21.

Text Books:

1. Introduction to the Constitution of India by Durga Das Basu (Students Edn.) Prentice-Hall EEE, 19th /20th Edition, 2001.
2. An Introduction to Constitution of India by M. V. Pylee, Vikas Publishing, 2002.

Institute Open Elective Course

Course Code	BSC261			
Category	Basic Science Course			
Course title	Mathematical Foundation for Engineering			
Scheme and Credits	L	T	P	Credits
	2	0	0	Audit

Course Objective:

1. To develop the sound conceptual understanding of Algebra, coordinate geometry, complex numbers, vectors, matrices, Calculus and Differential Equations.
2. To develop the foundation for engineering mathematics and other engineering courses.

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

1. Analyze the structure of complex numbers, quadratic equations, vectors and matrices and their uses.
2. Find the standard and general equations of lines, circles, conic sections, and their properties.
3. Sketch the graphs of functions and can evaluate limit, continuity, derivatives, integrations.
4. Formulate and solve first order differential equations.

Course Articulation Matrix:

PO → / ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	1	2								2
CO2	3	3	1	2								1
CO3	3	3										1
CO4	3	3	2									2

Note: 1-Low, 2-Medium or 3- High

Unit-1 Complex Numbers (05 hours)

Complex numbers as ordered pairs. Argand's diagram. Triangle inequality. Powers and roots of complex numbers, De Moivre's Theorem.

Unit-2 Algebra (05 hours)

Quadratic equations and express-ions. Permutations and Combinations. Binomial theorem for a positive integral index.

Unit-3 Coordinate Geometry (07 hours)

Coordinate Geometry: Locus. Straight lines. Equations of circle, parabola, ellipse and hyperbola in standard forms. Parametric representation.

Unit-4 Vectors and Matrices (08 hours)

Addition of vectors. Multiplication by a scalar. Scalar product, cross product and scalar triple product with geometrical applications. Matrices and Determinants: Algebra of matrices. Determinants and their properties. Inverse of a matrix. Cramer's rule.

Unit-5 Differential Calculus (10 hours)

Function. Inverse function. Elementary functions and their graphs. Limit. Continuity. Derivative and its geometrical significance. Differentiability. Rules of derivatives, Applications of Derivatives: Tangents and Normals, Increasing and decreasing functions. Maxima and Minima

Unit-6 Integral calculus (10 hours)

Integration as the inverse process of differentiation. Integration by parts and by substitution. Definite integral and its application to the determination of areas (simple cases). Solving first order differential equations: Exact differential equations and first order linear differential equations.

References:

1. Bernard and Child, Higher Algebra, Macmillan and Co. Pvt. Ltd, New York.
2. J.V. Uspensky, Theory of equations, macGraw Hill Publications.
3. S. L. Loney, The Elements of Coordinate Geometry, Macmilliams and Co., New York
4. G. B. Thomas, M.D.Weir, J. Hass, Thomas' calculus, 12th edition, Pearson Publications
5. H. Anton, C. Rorrers, Elementary Linear Algebra Applications version, 9th edition, Wiley publications.

SEMESTER-II

Mathematics–IV: Statistical Methods and Complex Analysis

Course Code	BSC275			
Category	Basic Science Course			
Course title	Statistics, Probability and Complex Analysis			
Scheme and Credits	L	T	P	Credits
	3	0	0	3

Course Objectives:

1. To provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
2. To understand probability distributions and their properties
3. To learn the statistical parameters for different distributions, correlation and regression
4. To understand the method of curve fitting, testing of hypothesis, goodness of fit
5. Identify and construct complex-differentiable functions and use conformal mapping
6. Use the general Cauchy integral theorem and formula, Residue Theorem, and Express functions as infinite series or products.

Course Outcomes:

1. To develop techniques of data interpretation.
2. Develop problem solving techniques needed to accurately calculate probabilities and describe the properties of discrete and continuous distribution functions.
3. Use statistical tests in testing hypotheses on data.
4. Determine whether a given function is analytic and apply analyticity on harmonic functions and conjugates of harmonic functions.
5. Transform a region to another region using conformal mapping and will be able to evaluate complex integrals, classify singularities and poles, find residues.

Course Articulation Matrix:

PO → / CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3										2
CO2	3	3	2									2
CO3	3	3	2	3		1						2
CO4	3	3	2	2		1					1	1
CO5	3	3	2	1								2

Unit 1: Analysis of Statistical Data **(03 hours)**

Frequency distribution; Frequency curve and histogram; Measure of central tendency and dispersion.

Unit 2: Random variables and Probability Distributions (08 hours)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications**.**

Unit 3: Sampling Distributions and Interval of Estimation (08 hours)

Sampling Distributions: t distribution, Chi-square distribution, F-distribution; Interval of estimation

Unit 4: Testing of Hypothesis (08 hours)

Relation between confidence interval and testing of hypothesis; testing of hypothesis, classification of hypothesis tests; large sample tests, small sample tests.

Unit 5: Complex Variable- Differentiation (08 hours)

Functions of complex variables, Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, elementary analytic functions; conformal mappings.

Unit 6: Complex Variable – Integration (10 hours)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Residue theorem and evaluation of real integrals.

References:

1. E. Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015.
2. V. K. Rohatgi and A.K. Md. Ehsanes Saleh, An Introduction to Probability and Statistics, 2nd Edition.
3. D. C. Montgomery and G.C. Runger, "Applied Statistics and Probability for Engineers", 5th edition, John Wiley & Sons, (2009).
4. P. S. Mann, Introductory Statistics, Wiley Publications, 7th edition (2013).
5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.

PCC-EE206 Electrical Machines- II

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	-	2	3	1	4

Prerequisite:

1. Fundamentals of Electrical Engineering.
2. Basics of Electromagnetism.

Course objectives:

1. To introduce fundamentals, physical concepts, and operating principles of AC machines and special machines.
2. This course aims at building a strong foundation of student in synchronous machines and induction motors with their advantages and disadvantages.
3. To help students in understanding performances of machines under different operating conditions and their testing methodology.
4. To teach students different speed control methods of AC machines.

Course outcomes:

Upon successful completion of this course, a student should be able to:

1. Understand the operation of AC machines
2. Implement various testing methods to detect fault.
3. Analyze performance characteristics of ac machines.
4. Implement erection and commissioning of AC Machines as per requirement.
5. Understand the application of special purpose machine.

Course Articulation Matrix:

PO ➡ / ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	1	2	-	2	2	2	1	1
CO2	2	3	2	2	1	2	2	2	1	1
CO3	3	3	3	2	1	2	1	1	1	1
CO4	2	3	2	3	1	2	1	1	1	1
CO5	2	2	2	2	2	1	-	-	-	-
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit 1: Synchronous Generators or Alternators (6 Hours)

Classification of A.C. Machines, Ferraris Principle, Production of 2- phase and 3-phase rotating magnetic fields, principle of operation and constructional (salient and non-salient pole) features of synchronous generators. Production of sinusoidal alternating EMF and its frequency, armature winding, winding factor, EMF equation. Harmonics in voltage waveform, leakage reactance, armature reaction. Short circuit ratio, synchronous reactance, synchronous impedance,

determination of voltage regulation (by Potier, EMF, MMF methods), power developed by synchronous generators, phasor diagrams, transient conditions, losses and efficiency.

Unit 2: Parallel Operation of Alternators (6 Hours)

Conditions for parallel operation, Load sharing between two alternators in parallel, Parallel-Generator theorem Process of synchronizing an alternator with infinite bus-bars by lamp methods & by use of synchroscope, Synchronizing torque, power and current.

Unit 3: Synchronous Motors (8 Hours)

Construction & principle of operation, various methods of starting, phenomenon of hunting or phase – swinging – its remedies. Operation of 3-phase Synchronous motor with constant excitation & variable load. Significance of torque angle, load characteristics Phasor diagram on the basis of synchronous impedance. Power flow chart, losses, Operation of 3-phase synchronous motor with a constant mechanical load on its shaft & variable excitation. ' V' Curves &'Inverted V' (pf) curves. Merits and demerits of synchronous motors & its application.

Unit 4: Three Phase Induction Motors (8 Hours)

Construction & principle of operation, types of I.M, slip, frequency of rotor current, rotor EMF, current, pf and torque. Phasor diagrams, different torque equations and relation between them. Torque-Slip, current-speed and Torque- Speed Characteristics, Losses and efficiency. Circle diagrams, starters. I.M tests, cogging and crawling, speed control, deep bar/ double cage rotor, Induction generator. Applications, advantages and disadvantages of I.M.

Unit 5: Single Phase Induction Motors (6 Hours)

Introduction, single phase induction motors, double revolving field theory, circuit model ofsingle phase induction motor, determination of circuit parameters and types of single phase I.M.Torque-slip characteristics & applications. Comparison of 1-phase induction motor with 3-phase induction motor.

Unit 6: Special Purpose Motors (6 Hours)

Construction, principle of working, characteristics, ratings & applications of Brushless DC motors, Permanent Magnet motor, linear induction motors, AC series motors, universal motors, repulsion type motors, Schrage motor, servo motors, hysteresis motor.

Text/Reference Books:

1. I. J. Nagrath, D P Kothari; "Electric Machines," Tata McGraw Hill Publication. Second Edition (Reprint) 2003.
2. A. E. Fitzgerald, C. Kingsley, S. D. Umans. "Electrical Machinery" Tata McGraw Hill. Sixth Edition 2002.
3. B. L. Theraja, A.K. Theraja,, A Textbook of Electrical Technology, Vol-II, S.Chand & Co. New Delhi, 2005.
4. Say. M.G - Performance & Design of Alternating Current Machine.(English Language Book Society), CBS Publisher (2002).
5. Ashfaq Hussein - Electrical Machines, Dhanpat Rai Publication (2012).
6. Bhimbra. P.S – Electrical Machines), Khanna Publication (2011).
7. J.B. Gupta – Electrical Machines, SK Kataria & Sons Publication (2010).

Term work:
It will consist of a record of at least eight experiments from the following list based on the Prescribed syllabus.

1. O.C. and S.C. test on Alternator: Determination of its regulation by the EMF method and MMF method.
2. Direct loading test on three phase Alternator.
3. Determination of axis reactance's of salient pole synchronous machine- Slip Test.
4. Zero power factor test on alternator: Regulation by Potier method and A.S.A. method
5. Synchronizing of alternators: Lamp Methods and use of synchroscope.
6. Load test on three phase squirrel cage induction motor.
7. Determination of Squirrel cage induction motor performance from Circle diagram.
8. Load test on three phase Slip ring induction motor.
9. Effect of rotor resistance on starting torque and maximum torque for three phase Slipring induction motor.
10. Load test on single phase induction motor.
11. Operation of induction motor as induction generator.
12. "V" and "inverse V" curves of synchronous motor at no load and constant load.
13. Load test on Synchronous motor at various voltages and frequency.
14. Load test on Induction motor at various voltages and frequency.
15. Study of induction motor starters..

Continuous Evaluation of Practical's:
Continuous Evaluation of Practical's performed per week will be carried on weekly basis till the end of semester and assessment will be done according to it.

PCC-EE207 Digital Electronics and Logic Design

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	-	2	3	1	4

Prerequisite:

1. Knowledge of Basic Electrical Engineering

Course objectives:

1. To introduce the number systems, codes and logic families.
2. To introduce the basic postulates of Boolean algebra, correlation between Boolean expressions and methods for simplifying Boolean expressions.
3. To analyse the logic processes and implement logical operations using combinational logic circuits.
4. To understand the concepts of sequential circuits and to outline the formal procedures for analysis and design and sequential circuits.
5. To understand the characteristics of memory and their classification, concept of Programmable Devices, PLA, PAL, CPLD and FPGA.

Course Outcomes:

After completing this course, student will be able to-

1. Represent numerical values in various number systems and perform number conversions between different number systems.
2. Understand the various logic families and characteristics of digital ICs.
3. Simplify the logic expressions using Boolean laws and postulates, K-map.
4. Analyse, design and implement the combinational logic circuits using Logic gates, MSI chips.
5. Analyse, design and implement the sequential digital logic circuits using flip flops, registers, counters.
6. Design A/D and D/A converters.
7. Classify different semiconductor memories, analyse digital system design using PLD and design ROM as PLD.
8. Design, implement and troubleshoot the digital circuits.

Course Articulation Matrix:

PO ➡ / ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	2	2	1	2	2	2	1	2
CO2	2	3	2	2	2	2	1	2	2	1
CO3	3	2	3	2	1	1	2	2	2	1
CO4	2	3	2	1	2	2	1	2	2	1
CO5	2	2	3	2	2	2	-	-	-	-
CO6	2	2	2	2	2	2	-	-	-	-
CO7	3	2	2	1	2	1	2	-	-	-
CO8	2	2	2	1	2	2	1	-	-	-
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit 1: Fundamentals of digital systems and logic families (8 Hours)

Digital Signals, digital circuits, NAND and NOR operations, EX-OR operation, Boolean algebra, examples of IC Gates, number systems-binary, signed binary, Octal, hexadecimal numbers, binary and BCD arithmetic, one's and two's complement arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families-RTL, DCPL, I2L, DTL, HTL, TTL, schottky TTL, ECL, MOS Logic, CMOS Logic, interfacing CMOS and TTL, Tri-state logic.

Unit 2: Combinational digital circuits (9 Hours)

Standard representation for logical functions, K-map representation. Simplification of logical functions using four, five and six variable K-maps. minimization of logical functions- don't care conditions, logic design using MSI chips- multiplexer, de-Multiplexer/decoders, adders, subtractors, carry look ahead adder, elementary ALU design, popular MSI chips, digital comparator, parity checker /generator, code converters, priority encoders, decoder/drivers for display devices, Quine-McClusky method of function realization.

Unit 3: Sequential circuits and systems (9 Hours)

1-Bit memory cell, properties of bistable latch, clocked SR flip flop, J-K, T and D types of flip flop, applications of flip-flops- shift register and counter types, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, serial adder, ripple (asynchronous) counters, synchronous counters, counter design using flip-flops, special counter ICs and applications.

Unit 4: A/D and D/A converters (8 Hours)

Digital to analog converter types: weighted resistor and R-2R ladder, 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, types: successive approximation, counting type, single slope and dual Slope A/D converters, 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 (PLDs) (6 Hours)

Memory organization and operation, expanding memory size, classification and characteristics of memory, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge-coupled device memory (CCD), commonly used memory chips, ROM as a PLD, programmable logic array, programmable array logic (PAL) and generic array logic (GAL) devices, complex programmable logic devices (CPLDs)- field programmable gate array (FPGA).

Text Books:

1. Jain R.P., Modern Digital electronics, Tata McGraw Hill Edition, 6th Edition2006.
2. Anand Kumar, Fundamentals of Digital Circuits Prentice-Hall India, 2003.

Reference Books:

1. Anand Natrajan, Digital Design, PHI Publication, 2011.
2. Morris M., Mano, Digital Design, Tata McGraw Hill, 4th edition, 2006.
3. Fletcher W. I., An Engineering Approach to Digital Design, Prentice Hall of India, New Delhi.1997.
4. Wakerly J. F., Digital design- Principles and Practices, P H International /Pearson India, 4th edition, 2005.
5. Samuel C. Lee, Digital Circuits and Logic Design, Prentice Hall of India, New Delhi, 1976.

Term Work:

1. Study and verify the truth tables of basic and universal logic gates.
2. Verification of Boolean Laws & D Morgan's theorem.
3. Design and implement code converters.
4. Design and implement arithmetic circuits: Half Adder and Full Adder, Sub tractor, BCD Adder/ Sub tractor.
5. Design and implement logical functions using logic gates, multiplexer, demultiplexer, encoders, decoders.
6. Design and implement Flip Flops: S-R, J-K, D, T, master slave J-K.

7. Design and implement counters: Up, down, up-down, decade, binary, BCD counter.
8. Study of D/A & A/D converters: R-2R ladder, weighted register method, successive approximation.
9. Study of Memories.
10. Design of Decoder driver to drive 7 segment LED display.

Continuous Evaluation of Practical's:

Continuous Evaluation of Practical's performed per week will be carried on weekly basis till the end of semester and assessment will be done according to it.

PCC-EE208 Electrical and Electronics Measurements

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	-	2	3	1	4

Prerequisite:

1. Fundamentals of Electrical Engineering.
2. Concept of galvanometer, Wheatstone bridge.

Course objectives:

1. To reveal knowledge of measurement of electrical quantities.
2. Understanding the construction and operating principles of electrical instruments.
3. To understand all electrical equipment's used for measuring various parameters.

Course outcome:

On completion of this course, students should be able to:

1. Recall the basics of measurement, state the purpose of measurement and identify the error sources and minimize its effect in particular measurement.
2. Understanding the operation and usage of various analysing instruments.
3. Demonstrate the working principles of instruments for power and energy measurements.
4. Explain the basic features of oscilloscope and different types of oscilloscope.
5. Identify and evaluate AC and DC bridges for measurement of R, L, C network.
6. Choose appropriate electronic instrument to measure, display and record electrical quantities.

Course Articulation Matrix:

PO ➡ ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	3	2	1	2	2	-	2	1	1
CO2	2	3	2	2	2	2	-	-	-	-
CO3	2	2	2	1	1	2	1	1	1	1
CO4	2	2	2	2	2	-	-	-	-	-
CO5	3	2	1	1	1	-	-	-	-	-
CO6	1	2	1	2	1	1	-	-	-	-
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit 1: Introduction to measurements (6 Hours)

Measurement, purpose of measurement, experimental data and errors: measurement recording and reporting, graphical representation of data, precision and accuracy, resolution and sensitivity, errors in measurement, statistical evolution of measurement data and errors

Unit 2: DC and AC bridges (6 Hours)

D.C bridges: low, medium and precise resistance measurement. Inductance and capacitance measurements. Detectors in bridge measurement, Wagner ground connections, transformer ratio bridges, digital RCL meter, Q meter.

Unit 3: Analog DC and AC meters (6 Hours)

PMMC, galvanometer, DC ammeter, DC voltmeter, electro dynamometer type of instruments, analog multimeter, special purpose analog meters, how to use basic meters and meter errors.

Unit 4: Power and Energy Measurements (8 Hours)

Electrodynamic wattmeters, Hall effect wattmeter, thermal type wattmeter, compensated wattmeter, single and three phase power measurement, calibration of wattmeter. Energy measurement, maximum demand meter, P.F meter, Megger.

Unit 5: Cathode ray oscilloscope (8 Hours)

Introduction, block diagram of a general purpose CRO, cathode ray tube, focusing device, post deflection acceleration, beam transit time and frequency limitations, oscilloscope time base, oscilloscope amplifiers, attenuators, basic controls, types of sweeps, delay line, display of electrical signals by oscilloscope, basic oscilloscope patterns, measurement of voltage, frequency and phase.

Unit 6: Electronic instruments (6 Hours)

Digital voltmeter, digital multimeter, digital frequency meter system, frequency meter accuracy, time and ratio measurement, counter/time/frequency meter, phase measurement.

Display devices and recorders

LED, LCD display, strip-chart recorder, X-Y recorder, 3-D printers

Term work:

Shall consist of at least six to eight practical's based on above syllabus. Some of the experiments may be from the following list.

1. Measurement of resistance (high, medium, low)
2. Measurement of inductance.
3. Measurement of capacitance.
4. Phase and frequency measurement on CRO using Lissajous pattern.
5. Study of digital voltmeter, digital multimeter.
6. Study of recorders.
7. Digital measurement of phase and frequency.
8. Study of AC and DC meters.

9. Measuring current and voltage.

Continuous Evaluation of Practical's:
Continuous Evaluation of Practical's performed per week will be carried on weekly basis till the end of semester and assessment will be done according to it.

Text/Reference Books:

1. A.K. Sawhney, "A course in Electrical & Electronic Measurements &Instrumentation", Publication-Dhanpat Rai& Sons, Edition 2002.
2. E.W Golding; "Electric Measurement & Measuring Instruments", Publication - A. H. Wheeler & Co, Allahabad, Edition 1983.
3. Helfrick and cooper, "Modern Electronic Instrumentation &Measurement Techniques", Publisher- Pearson, Edition 2007.
4. M. A. Baldwin, "Fundamentals of Electrical Measurements", Publication - Lyall Book Depot, Ludhiyana, Edition 1985.
5. M.U. Reissland, "Electrical Measurements", Publication - Wiely Eastern Ltd, New Delhi, Edition1992.
6. V. Popov; "Electrical Measurements" Publication – Mir, Moscow, Edition 1970.
7. Jones B.E.; "Instrumentation Measurement & Feedback", Publication – Tata McGraw Hill, NewDelhi, Edition 1978.
8. J. B. Gupta, Electrical and Electronic Measurements & Instrumentation, S. K. Katariya & Sons, 1969.

PCC-EE209 Signals and System

L	T	P	Credits(Th)	Credits(P)	Total Credits
3	-	-	3	0	3

Prerequisite:
1. Students will required to do arithmetic operation
2. Basic Knowledge derivative, integration, mathematics.
3. Knowledge of Trigonometry.

Course objectives:
The course is designed to provide the fundamental concepts in signals and systems. The course objectives are listed below:
1. Understanding the fundamental characteristics of signals and systems. ,
2. Development of the mathematical skills to solve problems involving convolution, filtering and sampling.
3. Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that are necessary for the analysis of continuous and discrete-time signals and systems.
4. Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc.
5. Knowledge of frequency-domain representation and analysis concepts using Fourier analysis tools, Z-transform.

Course outcome:

1. To know different types of signals and systems and demonstrate an understanding of characteristics of continuous and discrete -time signals and LTI systems.
2. To understand fundamental properties and behavior of LTI systems and be able to determine response of the system for given input.
3. To use the tools (e.g. orthogonal transforms: Fourier transform, Laplace transform, z-transform etc.) for analysis and design of an LTI systems.
4. To analyze the behavior of LTI systems in time and frequency domain using impulse response and transfer function respectively.
5. To understand the sampling theorem and the limitations of processing the signals digitally.
6. To design a simple LTI system like low-pass or high-pass filters.

Course Articulation Matrix:

PO ➡ ⬇ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	2	2	1	2	1	2	1	1	1
CO2	2	1	2	1	2	1	2	2	1	1
CO3	2	2	2	1	2	2	1	2	1	1
CO4	3	2	1	2	1	-	-	-	-	-
CO5	2	1	2	2	1	2	-	-	-	-
CO6	2	3	1	2	1	2	1	-	-	-
(3) High, **(2)** Medium, **(1)** Low										

Syllabus:

Unit 1: Continuous–Time and Discrete –Time Signals: (06 Hours)
Various classifications; Mathematical Representation; Signal Energy and Power. Transformations of the Independent Variable; Periodic Signals; Even and Odd Signals; Arithmetic Operations on Sequences; Continuous-Time and Discrete-Time Complex Exponential. The continuous-Time Unit Step and Unit Impulse Functions. The Discrete Time Unit Impulse and Unit Step Sequences; Representation of Discrete Time Signals in Terms of impulse.

Unit 2: Continuous-time and discrete-time systems (03 Hours)
Interconnections of Systems; Basic System Properties (Causality, Stability, Time-Invariance, Linearity, Invertibility, systems with and without, memory).

Unit 3: Linear time –invariant systems (06 Hours)
Discrete–time and continuous-time LTI systems; Unit impulse response; convolution sum and convolution integral representation. Properties of LTI systems (commutative, distributive, associative properties, invertibility, causality, Stability). Unit step response of an LTI system; LTI systems described by differential and difference equations; block diagram representations; singularity functions.

Unit 4: Fourier series representation of periodic signals (06 Hours)
Response of LTI systems to complex exponential; Fourier series representation of continuous-time and discrete–time periodic signals; convergence of the Fourier series; properties of discrete time and continuous-time Fourier series; Fourier series and LTI systems.

Unit 5: Continuous-time Fourier transform (06 Hours)
Representation of continuous-time aperiodic signals and continuous time Fourier transform; the Fourier transform for periodic signals; properties of continuous-time Fourier transform; Fourier transform and LTI systems.

Unit 6: Discrete- time Fourier transform (03 Hours)
Representation of discrete-time a periodic signals and the discrete time Fourier transform; Fourier transform for periodic signals; properties of the discrete-time Fourier transform; discrete-time LTI systems and discrete-time Fourier transform.

Unit 7: Sampling (03 Hours)
Representation of a continuous–time signal by its samples; sampling theorem; reconstruction of signals from its samples using interpolation; effect of under sampling (frequency domain aliasing); discrete time processing of continuous–time signals.

Unit 8: Laplace transform (06 Hours)
Laplace transform; region of convergence for Laplace transform; properties of Laplace transform; geometric evaluation of the Fourier transform from the pole-zero Plot; properties of Laplace transform; analysis and characterization of LTI systems using the Laplace transform; system transfer function; block diagram representations; unilateral Laplace transform; solution of differential equations using the unilateral Laplace transform

Unit 9: Z – Transform (06 Hours)
Z-Transform; region of convergence for the z-Transform; geometric evaluation of the Fourier transform from the pole-zero plot; properties of Z-Transform; analysis and characterization of discrete-time LTI Systems using Z-Transform; system transfer function; block diagram representation; unilateral Z-transform; solution of difference equation using the unilateral Z-Transform.

Reference Books:
1. A. V. Oppenheim, A. S. Willsky with S. H. Nawab, Signals and Systems, Prentice- Hall of India Private Limited, Second Edition, 1997.
2. S. Haykin and B. V. Veen, Signals and Systems, John Wiley and Sons, Inc., Second Edition, 1999.
3. M. J. Roberts, Signals and Systems: Analysis using, Transform Methods and MATLAB, Tata McGraw-Hill Publishing Company Limited, Second Edition, 2003.

HMC278 Human Values and Professional Ethics

L	T	P	Credits(Th)	Credits(P)	Total Credits
2	-	-	2	0	2

Course Objectives:

1. To create an awareness on Professional Ethics and Human Values.
2. To help students understand the Harmony for life.
3. To understand co-existence.
4. To study the moral issues and decisions confronting individuals and organizations In profession.

Course Outcomes:

After completion of the course the student is able to:

1. Understand the core human values that shape the ethical behavior of a person.
2. Understand how values act as an anchor of actions for life.
3. Learn the need of Human values and Professional ethics in life.
4. Understand Harmony at Four levels of life.
5. Learn the moral issues and problems in profession and find the solution to those problems.
6. Understand the core human values that shape the ethical behavior of a person.

Course Articulation Matrix:

(3) High, **(2)** Medium, **(1)** Low												
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1			1			2		3				
CO-2								3				
CO-3								3				3
CO-4						2		3				
CO-5			1			2		3	2			3

Unit 1: Course Introduction **(5 Hours)**

Need, basic guidelines, content and process for value education Understanding the need, basic guidelines, content and process for value education. A look at basic aspirations: self-exploration, happiness and prosperity, Fulfilment of human aspirations and harmony.

Unit 2: Understanding the Harmony **(5 Hours)**

Thoughtful human being harmony, sentient, attitude and its importance in relationship, significance of restraint and health *(Yama and Niyama)*, Egoism, Altruism, Universalism (idea of Sarvodaya and Vasudevkutumbakam), The problem of hierarchy of values and their choice (View of Pt Madan Mohan Malviya and Mahatma Gandhi), human goal settings and life management techniques.

Unit 3: Understanding professional Ethics **(5 Hours)**

Harmony at various levels and understanding professional ethics, creating environmentally aware engineers, humanistic universal education, natural acceptance of human values, ethical human conduct.

Unit 4: Competence of professional ethics **(5 Hours)**

Management models for present technologies, strategies for integrating humans in family and at all levels of existence, relevance of the above strategies in becoming responsible engineers, technologists and managers.

Unit 5: Motivation **(2 Hours)**

Contribution of ancestors in science and technology development to raise self-esteem in Indian context.

Suggested Readings / Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.
2. A Nagraj, 1998, Jeevan Vidyaek Parichay, Divya Path Sansthan, Amarkantak.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
5. A.N. Tripathy, 2003, Human Values, New Age International Publishers
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi TantraShodh, Amravati.
7. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
8. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
9. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd
10. Subroto Bagchi, The Professional
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008. Scheme and Syllabus Bachelor of Computer
13. Dr. Nityanand Mishra Niti Shastra ,Motilal Banarasidas 2005.
14. Dr. Avdesh Pradhan Mahatma ke Vichar , BHU Varanasi 2007.