SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electrical and Electronics Engineering) III – SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration In Hrs	
Theory Courses										
1	ES302CE	Engineering Mechanics	3	1	-	4	30	70	3	4
2	BS205MT	Mathematics – III	3	1	-	4	30	70	3	4
3	PC401EE	Electrical Circuit Analysis	3	-	-	3	30	70	3	3
4	PC402EE	Electromagnetic Fields	3	-	-	3	30	70	3	3
5	PC403EE	Electrical Machines – I	3	1	-	4	30	70	3	4
6	PC403EC	Analog Electronic Circuits	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC451EE	Electrical Circuits Lab	-	-	2	2	25	50	3	1
8	PC452EE	Computer Aided Electrical Drawing Lab	-	-	2	2	25	50	3	1
9	PC453EC	Analog Electronic Circuits Lab	-	-	2	2	25	50	3	1
Total			**18**	**3**	**6**	**27**	**255**	**570**	**-**	**24**

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core PE: Professional Elective
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam) EE: Electrical Engg.

Note:

1. Each contact hour is a clock hour.
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
ES302CE	**Engineering Mechanics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

The objectives of this course is to impart knowledge of

- Resolution of forces, equilibrium of force systems consisting of static loads
- Obtaining centroids and moments of inertia for various regular and irregular areas.
- Various forces in the axial force members, and to analyse the trusses using various methods,
- Concept of friction for single and connected bodies.
- Basic concepts of dynamics, their behavior, analysis and motion bodies
- Work energy principles and impulse momentum theory and applications to problem solving

Course Outcomes

After completing this course, the student will be able to:

1. Apply the fundamental concepts of forces, equilibrium conditions for static loads.
2. Determine the centroid and moment of inertia for various sections.
3. Analyse forces in members of a truss using method of joints and method of sections, analyse friction for single and connected bodies.
4. Apply the basic concepts of dynamics, their behavior, analysis and motion bodies.
5. Solve problems involving work energy principles and impulse momentum theory.

UNIT – I

Introduction to Engineering Mechanics: Basic Concepts

System of Forces: Coplanar Concurrent Forces, Components in Space – Resultant of coplanar and spatial systems, Moment of Force and Couple and its Application to coplanar system

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium and applications to Coplanar System.

UNIT – II

Centroid: Centroid of simple areas (from basic principles), Centroid of Composite areas.

Area Moment of Inertia: Definition, Moment of inertia of simple areas (from basic principles), Polar Moment of Inertia, Transfer formula, Moment of Inertia of Composite areas.

Centre of Gravity & Mass moment of Inertia: Centre of gravity and Mass moment of inertia of simple bodies (from basic principles).

UNIT-III

Friction: Theory of friction, Laws of friction, Friction connected to single and connected bodies. Wedge friction.

Analysis of Perfect Frames: (Analytical Method) Types of Frames, Assumptions for forces in members of perfect frame, Method of joints and Method of sections for Cantilever Trusses, simply supported Trusses.

UNIT –IV

Kinematics: Introduction, Motion of particle, Rectilinear and Curvilinear motions, Velocity and Acceleration, Types of Rigid body, Angular motion, Fixed axis rotation.

Kinetics: Introduction, fundamental equation of kinetics for a particle, D' Alembert's principle for particle motion, connected system and Fixed Axis Rotation.

UNIT – V

Work - Energy Method: Introduction, Equations for Translation, Work-Energy Applications to Particle Motion, Connected System and Fixed Axis Rotation.

Impulse Momentum Method: Linear impulse momentum, law of conservation of momentum, coefficient of restitution, Elastic impact**.**

Suggested Readings:

1. Ferdinand L. Singer, *Engineering Mechanics*, Collins, Singapore, 1994.
2. Reddy Vijay Kumar K. and K. Suresh Kumar, Singer's Engineering Mechanics, 2010.
3. S.S Bhavakatti, *Engineering Mechanics*, New age International publishers.
4. Rajeshakharam, S. and Sankarasubrahmanyam, G., *Mechanics,* Vikas Publications, 2002.
5. Junarkar, S.B. and H.J. Shah., *Applied Mechanics*, Publishers, 2001.
6. Shah., *Applied Mechanics*, Publishers, 2001.

Course Code	Course Title						Core/Elective
BS205MT	**Mathematics – III (Probability & Statistics)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- To provide an overview of probability and statistics to engineers

Course Outcomes

After completing this course, the student will be able to:

1. Solve field problems in engineering involving PDEs.
2. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

UNIT-I: Introduction of Probability, Conditional probability, Theorem of Total probability, Baye's Theorem and its applications, Random variables, Types of random variables, Probability mass function and Probability density function, Mathematical expectations.

UNIT-II: Discrete probability distributions: Binomial and Poisson distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions, Moments, Skewness and Kurtosis.

UNIT-III: Continuous probability distributions, Uniform, Exponential and Normal distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions.

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

UNIT-V: 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.

Suggested Readings:

1. R.K. Jain & Iyengar, "Advanced Engineering Mathematics", Narosa Publications.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
3. P. Sivaramakrishna Das & C.Vijaya Kumar, "Engineering Mathematics", Pearson India Education Services Pvt. Ltd.
4. N.P. Bali & M. Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 2010.
5. S.C. Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics" , S.Chand Publications.
6. P. G. Hoel, S. C. Port & C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
7. W. Feller, "An Introduction to Probability Theory and its Applications", Vol.1, Wiley, 1968.

Course Code	Course Title						Core/Elective
PC401EE	**Electrical Circuit Analysis**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Obtain the steady – state response of electrical circuits.
- Application of network theorems for the electrical circuits.
- Find Solution of first and second order networks.
- To Understand the application of Laplace transforms for electrical circuits
- Learn the behaviour of two port networks

Course Outcomes

At the end of the course students will be able to

1. Obtain steady-state response of electrical circuits.
2. Apply network theorems for the analysis of electrical circuits.
3. Analyse solution of first and second order RL, RC and RLC networks.
4. Apply Laplace transforms for electrical circuits
5. Analyse the behavior of two port networks

UNIT-I

Sinusoidal steady state analysis: Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power, series and parallel resonances. Analysis of three-phase circuits, analysis of magnetically coupled circuits with dot Convention.

UNIT-II

Network Theorems – AC/DC Excitation: Superposition theorem, Thevenin's 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-III

Solution of First and Second order networks: Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits with DC and AC excitation - initial and final conditions in network elements, forced and free response, time constants.

UNIT-IV

Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions.

UNIT-V

Two Port Network and Network Functions: Two Port Network parameters, impedance, admittance, transmission hybrid and inter-relationship of parameters, interconnections of two port networks. Driving point and Transfer functions.

Suggested Readings:

1. M. E. Van Valkenburg, *Network Analysis*, Pearson India Education Services Pvt. Ltd Third edition, 2019.
2. D. Roy Choudhury, *Networks and Systems*, New Age International Publications, 2013.
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, 2006.
6. Robert L Boylested, *Introductory Circuit Analysis*, Pearson, 2018.

Course Code	Course Title						Core/Elective
PC402EE	**Electromagnetic Fields**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Review of Vector Calculus
- Application and apply the various laws of static electrical and magnetic fields
- Understand the time varying the electrical and magnetic fields
- Understand the propagation of EM waves

Course Outcomes

At the end of the course students will be able to

1. Understand the vector calculus for electromagnetism.
2. Obtain the electric fields for simple configurations under static conditions.
3. Analyse and apply the static magnetic fields.
4. Understand Maxwell's equation in different forms and different media.
5. Understand the propagation of EM waves

In this course, 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-I

Review of Vector Calculus: 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-II

Static Electric Field: 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

Conductors, Dielectrics and Capacitance: 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 with single variable.

UNIT-III

Static Magnetic Fields: Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Magnetic Forces, Materials and Inductance: 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.

UNIT-IV

Time Varying Fields and Maxwell's Equations: Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Electrical and Magnetic boundary conditions.

UNIT-V

Electromagnetic Waves: 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.

Suggested Readings:

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. W.J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1990.
5. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
6. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Course Code	Course Title						Core/Elective
PC403EE	**Electrical Machines – I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- To understand the concepts of magnetic circuits.
- To understand electrical principle, laws, and working of DC machines.
- To understand the construction and characteristics and application of various types of DC generators and motors.
- To understand working of 1 – phase transformer and also conduct various tests on the transformer.

Course Outcomes

At the end of the course students will be able to

1. Understand the concepts of magnetic circuits.
2. Understand electrical principle, laws, and working of DC machines.
3. Analyse the construction and characteristics and application of various types of DC generators.
4. Analyse the construction and characteristics and application of various types of DC motors and testing of motors.
5. Understand electrical principle, laws, and working of 1–phase transformer and losses and also conduct various tests on the transformer.

UNIT-I

Electromechanical Energy Conversions: Introduction, Flow of Energy in Electromechanical devices, Energy in Magnetic Systems, Singly Excited System, Determination of Mechanical Force, Mechanical Energy, Torque Equation, Doubly Excited System, energy stored in magnetic field, Electromagnetic Torque, Generated EMF in Machines, Torque in Machines with Cylindrical air-gap, General classifications of Electrical Machines.

UNIT-II

DC machines: 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-III

DC machine - Generator: Armature circuit equation for generation, Types of field excitations - separately and self-excited, shunt, series and compound. 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 of generators.

UNIT-IV

DC machine – Motor: Armature circuit equation for motoring, torque-speed characteristics of separately excited, shunt, series motors and compound motors. Speed control methods. Losses and efficiency, Testing - brake test, Swinburne's test, Hopkinson's test and Field's test.

UNIT-V

Transformers: 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. Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers.

Suggested Readings:

1. A. E. Fitzgerald and C. Kingsley, *Electric Machinery*, New York, McGraw Hill Publisher,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. Smarajit Ghosh, *Electrical Machines*, Pearson Education, 2018
6. I. J. Nagrath and D. P. Kothari, *Electric Machines*, McGraw Hill Education, 2010.
7. P. Satish Kumar, G. Sridhar, *Electrical Machines – A Practical Approach*", De Gruyter Publication, Germany, 2020.

Course Code	Course Title						Core/Elective
PC223EC	**Analog Electronics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Study the characteristics of diode in forward and reverse bias and applications of diodes.
- Describe the construction and working of Bipolar Junction Transistor in various modes and JFET.
- Familiarize with feedback concepts and identify various types of feedback amplifiers.
- Study the importance of power amplifiers and Oscillators.
- Understand the operation and applications of op-amps.

Course Outcomes

At the end of the course students will be able to

1. Interpret the characteristics and apply diode models to analyse various applications of diodes
2. Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability
3. Analyse and compare feedback amplifiers.
4. Distinguish various classes of Power Amplifiers.
5. Analyse the operation of OPAMP and its applications

UNIT-I

P-N junction characteristics , V-I characteristics , Avalanche breakdown , Zener diode, Applications of Diodes as rectifiers. Filters (L, C), LED, photodiode. Basic Clipping and clamping circuits using diodes. (One level only)

UNIT-II

Bipolar Junction Transistor - V-I characteristics, JFET - I-V characteristics, and various configurations (such as CE/ CS, CB/CG, CC/CD) and their features. Small signal models of BJT and JFET. Analysis of BJT as an amplifier, estimation of voltage gain, current gain, input resistance, output resistance.

Transistor Biasing: Fixed bias, collector to base bias, self-bias, thermal stability, heat sinks **UNIT**

UNIT-III

Concept of Feedback - positive and negative, Feedback topologies : Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., and concept of stability. (Qualitative treatment only)

UNIT-IV

Oscillators: Barkhausen criterion, RC oscillators (phase shift, Wien bridge), LC oscillators (Hartley, Colpitts), CRYSTAL Oscillator. (Qualitative treatment only)

Power Amplifiers: Various classes of operation (Class A, B, and AB), their power efficiency and distortion (Qualitative treatment only)

UNIT-V

OP-AMP Block diagram, Ideal OP-AMP, DC and AC Characteristics, Inverting and Non-Inverting Amplifiers, Adder/ Subtracter, Integrator, Differentiator, Comparator, Zero crossing detector, Square and Triangular wave generators, Peak detector, Sample and Hold circuit and Precision Rectifiers.

Suggested Readings:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, Electronic Devices and Circuits, 3rd ed.,McGraw Hill Education, 2010.
2. S Salivahanan, N Kumar, and A Vallavaraj, Electronic Devices and Circuits, 2nd ed., McGraw HillEducation, 2007.
3. Jacob Milliman and Herbert Taub, "Pulse, Digital and Switching Waveforms",3rd Edition.
4. A.Anand Kumar "Pulse and Digital circuits".
5. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits" Pearson,2018, 4th edition

Course Code	Course Title						Core/Elective
PC451EE	**Electrical Circuits Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC401EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To Train the Students for acquiring practical knowledge in time response and frequency response of series / parallel RC, RL and RLC Circuits.
- To prepare the students for finds out parameters of a given two port network.
- To make the students for understanding the verification of theorems.

Course Outcomes

At the end of the course students will be able to

1. Evaluate the time response and frequency response character sties of R,L, C Series and parallel circuits.
2. Able to validate the network theorems.
3. Able to find various parameters of a two-port network.
4. Able to simulate electrical circuits using spice.
5. Able to synthesize networks from a given transfer function.

List of Experiments:

1. Charging and Discharging Characteristics of RC and RL series circuits.
2. Locus diagrams of RC and RL Circuits.
3. Frequencies Response of a Series RLC Circuits.
4. Frequencies Response of a Parallel RLC Circuits.
5. Parameters of two port network.
6. Series, parallel and cascade connection of two port networks.
7. Verification of Thevenin's and Norton's theorems.
8. Verification of Superposition theorem and Maximum power transfer theorem
9. Two Wattmeter method.
10. Simulation and transient analysis of series RLC circuits using PSPICE.
11. Mesh and Nodal analysis of electrical circuit using PSPICE.
12. Network Synthesis.
13. Characteristics of Linear, Non-Linear and Bilinear Elements.

Note: At least ten experiments should be conducted in the Semester.

Suggested Readings:

1. Van Valkenburg M.E., Network Analysis, Prentice Hall of India, 3rd Edition, 2000.
2. William Hayt H, Kimmerly Jack E, Steven Durbin M, Engineering Circuit Analysis, McGraw Hill, 6th Edition, 2002.
3. Jagan N.C, Lakshrninarayana C., Network Analysis, B.S. Publications, 3rd Edition, 2014.

Course Code	Course Title						Core/Elective
PC452EE	**Computer Aided Electrical Drawing Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ES301EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Identify and draw different components of electrical systems
- Draw different control and wiring diagrams
- Draw winding diagrams of electrical machines
- Draw different starter diagrams of A.C and D.C machine
- Acquire knowledge on various Electrical Engineering Softwares

Course Outcomes

At the end of the course students will be able to

1. Identify and draw different components of electrical systems
2. Draw different control and wiring diagrams
3. Draw winding diagrams of electrical machines
4. Draw different starter diagrams of A.C and D.C machine
5. Acquire knowledge on various Electrical Engineering Softwares

Drawing of the following using Electrical CADD / Corel Draw / MS Word / PPT/Visio

1. Lines, Arcs, Curves, Shapes, Filling of objects, Object editing & Transformation.
2. Electrical, Electronic & Electro – mechanical symbols.
3. House – wiring diagrams and layout.
4. Simple power and control circuit diagrams.
5. Electrical machine winding diagrams. (A.C & D.C)
6. Transmission tower, Overhead lines – ACSR conductors, Single circuit, Double circuit, Bundle conductor.
7. Constructional features of D.C motors, AC motors and Transformers.
8. D.C and A.C motor starter diagrams.
9. Lamps used in illumination
10. Single line diagram of Power System

Suggested Readings:

1. K.B. Raina, S.K. Bhattacharya, *Electrical Design, Estimating and Costing*, New Age International, 2007.
2. Nagrath, Kothari, *Electrical Machines*, Tata McGraw Hill Publishing Company Ltd., 2000.
3. A.K. Sawhney, *A Course in Electrical Machines Design*, Dhanpat Rai and Sons, 2016.

Course Code	Course Title						Core/Elective
PC253EC	**Analog Electronics Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Designing basic circuits of rectification with and without filters using diodes
- Designing wave shaping circuit using diodes.
- Designing of single and multistage amplifier circuits.
- Demonstrate negative feedback in amplifier circuits and positive feedback in Oscillators
- Design of P, PI and PID controllers.

Course Outcomes

At the end of the course students will be able to

1. Calculate ripple factor, efficiency and % regulation of rectifier circuits
2. Analyse feedback amplifiers and op-amp oscillator circuits
3. Design single, and multi-stage amplifier, wave shaping and controller circuits
4. Understand the characteristics of electronics devices
5. Design of P, PI and PID controllers using op-amps.

List of Experiments:

1. Characteristics of Silicon, Germanium and Zener Diode in forward bias and reverse bias
2. Application of diode as a full wave rectifier with and without filters. Calculation of Ripple factor,voltage regulation and efficiency with various loads
3. Static characteristics of BJT in CE configuration
4. Static characteristics of MOSFET in CS configuration
5. Frequency response of Single and two stage BJT amplifier in CE configuration
6. Frequency response of Single and two stage MOSFET amplifier in CS configuration
7. Inverting amplifier using op-amp.
8. Non-inverting amplifier using op-amp.
9. Instrumentation amplifier.
10. Design of integrator and differentiator using op-amp.
11. RC Phase Oscillator and Wein Bridge Oscillator using op-amp.
12. A/D converters.
13. Clipping circuits
14. Clamping Circuits.
15. Monostable Multivibrator using op-amp.
16. Generation of triangular and square wave using op-amp.
17. Design of P, PI and PID controller using op-amp.
18. Design of Lead/lag compensator using op-amp

Note: At least ten experiments should be conducted in the Semester

Suggested Readings:

1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, Basic Electronics, A text- Lab Manual, 7thEdition. Mc- Graw- Hill Higher Education 2001.
2. D Roy Chaudhary, Shail B Jain, Linear Integrated circuits, New Age International Publishers, 2007.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electrical and Electronics Engineering) IV – SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration In Hrs	
Theory Courses										
1	HS102EG	Effective Technical Communication in English	2	-	-	2	30	70	3	2
2	PC408EE	Power Systems – I	3	-	-	3	30	70	3	3
3	ES305ME	Energy Sciences and Engineering	2	-	-	2	30	70	3	2
4	PC409EE	Electrical Machines – II	3	1	-	4	30	70	3	4
5	PC410EE	Digital Electronics and Logic Design	3	-	-	3	30	70	3	3
6	PC411EE	Power Electronics	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	PC455EE	Electrical Machines Lab – I	-	-	2	2	25	50	3	1
8	PC456EE	Power Electronics Lab	-	-	2	2	25	50	3	1
9	PC457EE	Digital Electronics and Logic Design Lab	-	-	2	2	25	50	3	1
Total			**16**	**01**	**06**	**23**	**330**	**570**	**-**	**20**

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core PE: Professional Elective
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam) EE: Electrical Engg.

Note:

1. Each contact hour is a clock hour.
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
HS102EG	**Effective Technical Communication in English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**2**

Course Objectives

To expose the students to:

- Features of technical communication
- Types of professional correspondence
- Techniques of report writing
- Basics of manual writing
- Aspects of data transfer and presentations.

Course Outcomes

On successful completion of the course, the students would be able to:

1. Handle technical communication effectively
2. Use different types of professional correspondence
3. Use various techniques of report writing
4. Acquire adequate skills of manual writing
5. Enhance their skills of information transfer and presentations

UNIT I

Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)

UNIT II

Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.

UNIT III

Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.

UNIT IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.

UNIT V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested Readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication: Principles and Practice* (3rd ed.). New Delhi, OUP.
2. Rizvi, Ashraf, M. (2017). *Effective Technical Communication* (2nd ed.). New Delhi, Tata McGraw Hill Education.
3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). New Delhi, Tata McGraw Hill Education.
4. Tyagi, Kavita &Misra, Padma. (2011). *Advanced technical communication*. New Delhi, PHI Learning.
5. Jungk, Dale. (2004). *Applied writing for technicians*. New York, McGraw-Hill Higher Education.

Course Code	Course Title						Core/Elective
PC408EE	**Power Systems – I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course is introduced

- To be able to learn and understand the conventional and renewable generating power stations and economics of generation.
- To be able to understand design concepts of transmission lines and cables.

Course Outcomes

After successful completion of the course the students will be able to

1. The students will acquire knowledge in conventional renewable generating power stations and economics of generation
2. The students will acquire knowledge regarding the design concepts of t transmission lines and cables.

UNIT I

Economics of Power Generation: Load Curve, Load Demand and Diversified factors, Base Load and Peak load operation, Types of costs and depreciation fund calculations, Methods of power factor improvement, Economics of power factor improvement, Tariffs, Distribution: 2 wire and 3 wire distributors, Ring mains, AC distribution calculations.

UNIT II

Steam Power Stations: Choice of site, Layout & various parts of station, Boilers, Turbines, Super Heaters, Economizers, Air pre-heaters etc. and their Pulverized fuel, Coal handling. Hydro-Electric Power plants: Estimation Hydrograph, Flow duration curve, Mass curve, Storage and poundage, Types electric plants and layouts, Prime movers for hydro- electric plants.

UNIT III

Nuclear Power Plants: Fissile materials, working principle of nuclear plants and reactor control, Shielding, Types of reactors. Non-Conventional Energy Sources – Basic principles of Wind, solar, biomass and gas turbines.

UNIT IV

Over-Head Lines: Supports sag and tension calculations, Effect of wind and ice, Erection conditions, Insulators: Types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, Testing of insulators. Insulated Cables: Conductors for cables, insulating materials, Mechanical protection, Low voltage cables, Grading of cables, Three phase high voltage cables and Super voltage cables, Capacitance of three-core cables.

UNIT V

Inductance and Capacitance of Transmission Lines: Inductance and capacitance of overhead line conductors, Single phase and three-phase with symmetrical composite conductors, GMR and GMD Spacing, Transposition, Bundled conductors, Effect of earth capacitance.

Suggested Readings:

1. Wadhwa C.L., *Electrical Power Systems*, New Age International (P) Ltd., 4th Edition, 2007.
2. Wadhwa C.L., *Generation, Distribution and Utilization of Electrical Energy*, New Age International (P) Ltd., 4th Edition, 2006.
3. Singh S.N., *Electrical Power Generation*, Transmission and Distribution, Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.
4. V.K.Mehta, *Principles of Power Systems,* S. Chand and Co., 2007.

Course Code	Course Title						Core/Elective
ES305ME	**Energy Sciences and Engineering**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**2**

Course Objectives

The objectives of this course is to impart knowledge of

- Able to identify various sources of energy.
- Understand the difference between Conventional and renewable energy sources.
- Identify various storage devices of Energy.
- Able to estimate the costing of power plant.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the basics of various sources of energy
2. Analyze the present status of conventional energy sources.
3. Understand the working principles of Renewable Energy systems
4. Design and develop waste heat recovery systems.
5. Relate energy economics, standards and future challenges.

UNIT-I

Introduction: Various sources of energy, relative merits and demerits, Statistics and prospects of conventional and Renewable energy sources.

UNIT-II

Conventional Energy Sources: Fossil Fuels: Power generation using steam turbine and gas turbine power plants, Nuclear Fuels: Parts of reactor core, Nuclear power plant outline, Methods to dispose radioactive waste. Hydro Energy: Spillways, Hydroelectric power plant outline.

UNIT-III

Renewable Energy Systems: Solar Energy – Types of collectors and concentrators, Solar Photo Voltaic Cell. Wind Energy – Types of Wind Turbines and their working, geothermal power plant, Biomass conversion, Wave Energy power plant, Tidal Energy power plant, Ocean thermal energy power plant.

UNIT-IV

Storage: Methods to store Mechanical Energy, Electrical Energy, Chemical Energy and Thermal Energy. Co-generation &Tri-generation: Definition, application, advantages, classification, saving Potential. Energy waste, waste heat recovery classification, advantages and applications, commercially viable waste heat recovery devices.

UNIT-V

Power Plant Economics and Environmental Considerations: Costing, Estimation of power production - Pollutants and Pollution Standards -Methods of pollution control. Energy Efficiency rating and BEE standards, Future energy needs and challenges.

Suggested Reading:

1. Wakil MM, *Power Plant Technology*, McGraw Hill Publishers.
2. P.K. Nag, *Power Plant Engineering*, McGraw-Hill Publishers.
3. G.D. Rai, *Non-Conventional Energy Sources,* Khanna Publishers.
4. Mili Majumdar, *Energy Efficient Buildings in India,* Ministry of Non-Conventional Energy Sources.

Course Code	Course Title						Core/Elective
PC409EE	**Electrical Machines – II**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC403EE	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

- To be able to understand in detail about transformers and induction machines. Construction, principle, performance characteristics and testing.
- To understand the construction, principle and performance characteristics of fractional horse power motors.

Course Outcomes

After completing this course, the student will be able to:

1. Explain the rating, testing and applications of single phase, three phase transformers
2. Acquire the knowledge of Rotating magnetic field theory, Double field revolving theory
3. Develop equivalent circuit diagram of transformer, three phase induction motor and single-phase induction motor.
4. Develop Slip-torque characteristics of single phase and three phase induction motors
5. Demonstrate knowledge of Starting methods, Speed control methods and applications of single and three phase induction motors.

UNIT-I

Three - Phase Induction Motors: Constructional features - Rotating magnetic field theory, Principle of operation of Squirrel cage and Slip ring motors, Phasor diagram, Equivalent Circuit, Expression for torque, starting torque, Max torque. Slip-torque characteristics, Equivalent circuit parameters from no-load and blocked rotor test, Circle diagram, Determination of performance characteristics of induction motor, Applications.

UNIT-II

Starting and Speed Control Methods: Starting methods of 3-phase induction motor –Auto transformer, Star-delta Starter. Double cage machine, Speed control methods – Resistance control, Voltage Control, Pole changing, Cascading, Induction Generator - Principle of operation, Applications.

UNIT-III

Synchronous machines: Types and Constructional Details - Types of Winding, Winding factors - E.M.F. equation - Fractional pitch and fractional slot windings - Suppression of harmonics and tooth ripple - Armature reaction and reactance - Synchronous impedance. Synchronous Generator**:** Voltage Regulation - Phasor diagram of alternator with non-salient poles - O.C. and S.C. Characteristics- Synchronous impedance, Ampere turn, ZPF methods for finding regulation - Principle of two reaction theory and its application for the salient pole-synchronous machine analysis - Synchronizing and parallel operation.

UNIT - IV

Synchronous Motor: Theory of operation - Vector diagram - Variation of current and p.f. with excitation - Hunting and its prevention - Current and power circle diagram - Predetermination of performance - Methods of starting and synchronizing - Synchronizing power, Synchronous condenser. Applications.

UNIT-V

Single Phase Motors: Double field revolving theory. Equivalent circuit of single-phase induction Motor-Principle of operation, speed torque characteristics of a split phase and capacitor motors. Compensated and uncompensated series motor, Repulsion motor and universal motor - Applications.

Special Machines: Stepper Motors – Constructional features, Principle of operation, Types of Stepper Motors, Brushless DC Motor – Construction and Principle of Operation, Switched Reluctance Motor –Construction and Principle of Operation, Applications.

Suggested Readings:

1. P.S.Bimbhra, *Electrical Machinery*, 7th Edition, Khanna Publishers.
2. D.P. Kothari and I.J. Nagrath, *Electrical Machines,* Tata McGraw Hill, 4th Edition, 2010.
3. M.G.Say, *The Performance and Design of AC. Machines,* Pitman Publication, 2002.
4. Irving L. Kosow, *Electric Machinery and Transformers,* PPH, Pearson Education 2nd Edition, 2009.
5. P. Satish Kumar, G. Sridhar, *Electrical Machines – A Practical Approach*" by De Gruyter Publication, Germany, 2020.

Course Code	Course Title						Core/Elective
PC410EE	**Digital Electronics and Logic Design**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand and apply the Boolean algebra and arithmetic circuits.
- Apply combinational digital circuits for logic functions
- Logic gates, memory, including CMOS gates, flip-flops, arrays, and programmable logic.
- Design tools, both manual and computerized, for design, optimization, and test of logic circuits.

Course Outcomes

At the end of the course students will be able to

1. Understand and apply the Boolean algebra, including CMOS gates and arithmetic circuits.
2. Apply combinational digital circuits for logic functions
3. Use the concepts of Boolean Algebra for the analysis & design of sequential logic circuits
4. Design various A/D and D/A converters
5. Design various logic gates starting from simple ordinary gates to complex programmable logic devices and arrays.

UNIT- I

Fundamentals of Digital Systems and logic families: 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 lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT-II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, 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-M method of function realization.

UNIT-III

Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J, K, T and D-type flip flops, applicationsofflipflops,shiftregisters,applicationsofshiftregisters,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-IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, 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-V

Semiconductor memories and Programmable logic devices: 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).

Suggested Readings:

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.

Course Code	Course Title						Core/Elective
PC411EE	**Power Electronics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand the characteristics and performance of various power electronic devices.
- Analyze single and three phase controlled rectifier circuits.
- Understand choppers circuits and AC voltage controllers
- Understand the performance of single phase and three phase inverter circuits.

Course Outcomes

At the end of the course students will be able to

1. Understand the characteristics and performance of various power electronic devices.
2. Analyze single and three phase controlled rectifier circuits.
3. Understand choppers circuits and AC voltage controllers
4. Understand the performance of single phase inverter circuits.
5. Analyse the operation of three phase voltage source inverters.

UNIT-I

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: static and dynamic Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT-II

Thyristor Rectifiers: Single-phase half-wave, full-wave and semi controlled rectifiers with R-load and highly inductive load; Three-phase half wave, full wave and semi controlled bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

UNIT-III

DC-DC Converters: Elementary chopper with an active switch and diode concepts of duty ratio and average voltage, power circuit and operation of buck, boost and buck-boost converters in continuous conduction mode, duty ratio control of output voltage. AC-AC Converter: Power circuit and operation of single-phase AC Voltage Controller with R & RL Load. Basic concepts of Cycloconverter and Matrix converter.

UNIT-IV

Single-phase Inverter: Power circuit and operation of single-phase voltage source inverter in square wave mode, sinusoidal pulse width modulation (Unipolar and bi-polar), relation between modulation index and output voltage. Calculation of performance parameters of inverter.

UNIT-V

Three-phase Inverter: Power circuit and operation of three-phase voltage source inverter in 180^0 and 120^0 modes, Bi-polar sinusoidal pulse width modulation, relation between modulation index and output voltage. Elementary operation of CSI, Comparison of Voltage Source Inverter and Current source Inverter

Suggested Readings:

1. M. H. Rashid, *Power Electronics: Circuits, Devices and Applications*, Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, *Power Electronics: Converters, Applications and Design*, John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, *Fundamentals of Power Electronics*, Springer Science & Business Media, 2007.
4. L. Umanand, *Power Electronics: Essentials and Applications*, Wiley India, 2009.
5. Dr. P.S. Bhimbra, *Power Electronics*, Khanna Publishers, 2009.

Course Code	Course Title						Core/Elective
PC455EE	**Electrical Machines Lab - I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC403EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To learn operation and performance characteristics of d.c machines by conducting various experiments and tests practically.
- To understand the operation and performance characteristics of transformers by conducting various experiments and tests.

Course Outcomes

The students will be able to:

1. Estimate the efficiency and voltage regulation of D.C. generator and transformers under various loading conditions.
2. Acquire the knowledge of efficiency and speed regulation D.C. Motors under various loading conditions.
3. Able to understand the speed control of DC motor by conducting different experiments

List of Experiments:

1. Magnetization characteristics of a separately excited D.C. generator.
2. Determination of the load characteristics of shunt and compound generators.
3. Determination of the performance and mechanical characteristics of series, shunt and compound motors.
4. Separation of iron and friction losses and estimation of parameters in D.C. machine.
5. Speed control of D.C. Shunt motor using shunt field control and armature control methods.
6. Separation of core losses in a single phase transformer.
7. Open circuit and short circuit and load test on a single phase transformer.
8. Sumpner's test on two identical transformers.
9. Three phase Transformer connections.
10. Three phase to two phase transformation and open delta connection.
11. Retardation test.
12. Hopkinson's test.
13. Swinburne's test.

Note: At least ten experiments should be conducted in the Semester.

Suggested Readings:

1. P.S.Bimbhra, *Electrical Machinery*, Khanna Publishers 2006
2. D.P. Kothari & I.J. Nagrath, *Electrical Machines*, Tata McGraw Hill, 4th Edition, 2010.
3. M.G.Say, *The Performance and Design of AC. Machines*, Pitman Publication, 2002.
4. Irving L. Kosow, *Electric Machinery and Transformers*. PPH, Pearson Education, 2nd Edition, 2009.
5. P. Satish Kumar, G. Sridhar, *Electrical Machines – A Practical Approach*" by De Gruyter Publication, Germany, 2020.

Course Code	Course Title						Core/Elective
PC456EE	**Power Electronics Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PC411EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To be able to understand various power switching devices, trigger circuits, characteristics and applications by conducting the experiments.
- To learn and understand the rectifiers, choppers and inverters principle operation, characteristics and applications.

Course Outcomes

At the end of the course students will be able to

1. Able to understand speed control of motors by using controlled rectifier
2. Able to understand the applications of cyclo-converters
3. Able to simulate different power electronic devices using software.

List of Experiments:

1. R, RC, UJT Trigger Circuits for SCR's.
2. Design and fabrication of trigger circuits for single phase half and fully controlled bridge rectifiers.
3. Study of SCR chopper.
4. Design and fabrication of trigger circuit for MOSFET chopper.
5. Study of forced commutation techniques of SCRs.
6. Speed control of separately excited DC motor by controlled rectifier.
7. Speed control of universal motors using choppers.
8. Study of single phase half and fully controlled rectifier.
9. Study of single phase and three phase AC voltage controller.
10. Study of single phase dual converter.
11. Study of single phase cyclo converter.
12. IGBT based PWM inverters.
13. Simulation of single phase half and fully controlled rectifier.
14. Simulation of single phase and three phase AC voltage controller.
15. Simulation of single phase inverter & three phase inverter.

Note: At least ten experiments should be conducted in the Semester.

Suggested Readings:

1. Bimbra.P.S., *Power Electronics*, Khanna Publications, 2006.
2. Rashid M.H., *Power Electronics Circuits, Devices and Applications*, PHI, 2004.
3. Singh. M.D., Khanchandani K.B., *Power Electronics*, TMH, 14th reprint, 1999.
4. Mohan, Undeland and Robbins, *Power Electronic Converters. Applications and Design*, John Wiley & Sons, 3rd Edition, 2007.

Course Code	Course Title						Core/Elective
PC457EE	**Digital Electronics and Logic Design Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	Prerequisite	Contact Hours per Week
	L	T	D	L	T		L
PC410EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Identify the different types of number systems and their use.
- Explain the principle concepts of Digital Logic Design.
- Implement the logic circuits using Combinational Logic IC's.
- Distinguish between the Sequential and Combinational Logic Circuits.
- Reconstruct the Logic Circuits for real time applications with Combinational Circuits
- Formulate the Digital Logic Circuit function.
- Design the Logic Circuit using Combinational and Sequential Circuits

Course Outcomes

At the end of the course students will be able to:

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
1. Use PLCs to implement the given logical problem.
2. Analysis of synchronous and asynchronous counters.

List of Experiments:

1. Study and operation of IC tester, pulse generator and probe.
2. Realization of different logic gates.
3. Realization of inverter using different logic families.
4. Multiplexer application for logic realization and parallel to serial Conversions.
5. Synchronous counters.
6. Asynchronous counters.
7. Half adder, full adder and subtractor and realization of combinational logic.
8. A / D converters.
9. D / A converters.
10. Experiment on Sample and hold circuit.
11. Simulation of error detecting codes using VHDL/Verilog/Multisim
12. Simulation of encoder/decoder using VHDL/Verilog/Multisim
13. Simulation of flip/flops using VHDL/Verilog/Multisim
14. Experiment on programmable logic devices (ROM/RAM/PLA/PAL/FPGA)

Note: At least ten experiments should be conducted in the Semester.

Suggested Readings:

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.