PROGRAM OUTCOMES,PROGRAM SPECIFIC OUTCOMES, COURSE OUTCOMES

Program: B. Tech. in Electrical Engineering

<table>
<tr><th colspan="3">Bachelor of Technology</th></tr>
<tr><td>Programme Outcome</td><td colspan="2">Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td></tr>
<tr><td rowspan="3">Programme Specific Outcome</td><td colspan="2">Able to apply the knowledge gained during the course of the program from Mathematics, Basic Computing, Basic Sciences and Social Sciences in general and all electrical courses in particular to identify, formulate and solve real life problems faced in industries and/or during research work.</td></tr>
<tr><td colspan="2">Able to provide socially acceptable technical solutions to complex electrical engineering problems with the application of modern and appropriate techniques for sustainable development.</td></tr>
<tr><td colspan="2">Able to apply the knowledge of ethical and management principles required to work in a team as well as to lead a team.</td></tr>
<tr><td>Course Code</td><td>Course Name</td><td>Course Outcomes</td></tr>
<tr><td>EE336</td><td>Power System Protection Lab</td><td>To understand the need of protection of electric equipment and their protection schemes. Introduce students to power system protection and switchgear. To understand operations & characteristics of various</td></tr>
</table>

		electromagnetic and static relays. To understand the operations of various types of circuit breakers and their ratings. To understand the unit protection and over voltage protection of different apparatus in power system.
PY 103	Physics	• To impart knowledge in basic concepts of physics relevant to engineering applications. • To Introduce advances in technology for engineering applications
MA 103	Mathematics – I	To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions. • To introduce the fourier series that is fundamental to application of analysis to Engineering problems. • To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics. • To familiarize the student with functions of several variables that is essential in most branches of engineering.
EE 105	Basic Electrical Engineering	• Impart basic knowledge of electrical quantities such as D.C. and A.C. Current voltage, power, energy and frequency. • Provide working knowledge for the analysis of D.C. and A.C. circuits required for all branches of engineers. • Develop skills to identify the type of generators and motors required for practical application. • Highlight importance of transformers and transmission and distribution of electric power. • Provide knowledge of basic communication systems and different types of transducers • Design simple electronic circuits.
CP 107	Programming for Problem Solving	This course enables the students to apply the knowledge of Mathematics in various Engineering fields by improving the ability to apply knowledge of mathematics on engineering problems. It introduces the basic concepts required to understand, programming, basic algorithm, branching, loop and pointers.

EE 151	Electrical and Electronics Engineering Lab	Get an exposure to common electrical components and their ratings. ● Make electrical connections by wires of appropriate ratings. ● Understand the usage of common electrical measuring instruments. ● Understand the basic characteristics of transformers and electrical machines. ● Get an exposure to the working of power electronic converters.
PY 152	Engineering Physics Lab	● In this lab students gain practical knowledge by applying the experimental methods to correlate with the Physics theory. ● It learns the usage of electrical and optical systems for various measurements. ● It apply the analytical techniques and graphical analysis to the experimental data
CP 153	Programming for Problem Solving Lab	To formulate the algorithms for simple problems ● To translate given algorithms to a working and correct program ● To be able to correct syntax errors as reported by the compilers ● To be able to identify and correct logical errors encountered at run time ● To be able to write iterative as well as recursive programs ● To be able to represent data in arrays, strings and structures and manipulate them through a program ● To be able to declare pointers of different types and use them in defining self referential structures. ● To be able to create, read and write to and from simple text files.

ME 157	Engineering Graphics & Design Lab	Introduction to engineering design and its place in society • Exposure to the visual aspects of engineering design • Exposure to engineering graphics standards • Exposure to solid modelling • Exposure to computer-aided geometric design
EE 201	Electrical Circuit Analysis	1. Student will be able to analyse continuous time signals & systems 2. Apply Laplace transforms techniques. 3. Apply network theorems practically. 4. Evaluation of two port networks 5. Analyse positive real functions 6. Solve most simple and some complex circuits for their parameters (Voltage, current, power, etc.) using different network theorems and transforms
EE 202	Electronic Measurement & Instrumentation	1. Student will be able to measure the AC and DC electrical quantities(voltage, current and energy) 2. Measurement of single and three phase ac power 3. Calibrate the voltmeter, ammeter by the help of potentiometer 4. Measurement of earth resistance 5. Measure the value of capacitance and inductance by the help of different type of bridges 6. Identify the error in any measurement done and how to minimize it.
EE 202	Electronic Measurement & Instrumentation	1. Student will be able to measure the AC and DC electrical quantities(voltage, current and energy)

		2. Measurement of single and three phase ac power 3. Calibrate the voltmeter, ammeter by the help of potentiometer 4. Measurement of earth resistance 5. Measure the value of capacitance and inductance by the help of different type of bridges 6. Identify the appropriate type of measuring instrument to be used in each case, and how to make the measurements more accurately
EE 203	Analog Electronics	1. Explain the basic knowledge representation, problem solving, and learning methods Semiconductor Devices. 2. Asses the applicability, strength, and weakness of the basic knowledge representation ,problem solving and learning methods on Feedback Amplifier. 3. Develop intelligent system by assembling solutions of Oscillator. 4. Develop an interest in the Advantage of Small Signal Amplifiers at Low Frequency.
EE 204	Electrical Machine- II	1. Students can now apply the knowledge of AC machines in testing them for the study of speed control, efficiency calculation and their various characteristics. 2. Can design and develop new machines. 3. Design the machines for environmental friendly. 4. Can used Modern tools for control.
EE 205	Electrical Machines-I	1. Apply the knowledge about the machines in the field 2. Students can now apply the knowledge of DC machines in testing them for the study of speed 3. control, efficiency calculation and their various characteristics. 4. Students can now apply the knowledge of transformer to testing them for the study of efficiency

		5. calculation and their various characteristics. 6. Machine based problems can be solved.
EE 206	Power Electronics	1. Understand characteristics of different power electronic devices and differentiate between them 2. Understand how to trigger and protect SCR 3. Understand the applications of converters in industries 4. Understand the applications of pulse width modulation in industries 5. Understand the application of dc to dc converter in industries. 6. Make students familiar with various types of power converters, thus making them ready for work in industry.
EE 207	Electromagnetic Field	1. Understand the basic mathematical concepts related to electromagnetic vector fields. . 2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density. 3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density. 4. Understand the concepts related to Faraday‘s law, induced emf and Maxwell‘s equations. 5. Apply Maxwell‘s equations to solutions of problems relating to transmission lines and uniform plane wave propagation.
EE 208	Signals &Systems	1. Analyze different types of signals. 2. Represent continuous and discrete systems in time and frequency domain using different transforms. 3. Investigate whether the system is stable. 4. Sampling and reconstruction of a signal.

EE 209	Power Generation Process	1. Solve the problems on power plant economics 2. Solve the problems on power factor and tariff. 3. Evaluate the need of new of renewable energy 4. Prepare base for further study in power engineering. 5. Enable students to solve real life problems of power factor and tariff. 6. Work in industry on power system grids, knowing the various factors guiding the power system generation and economy.
EE 210	Digital Electronics	1. Students will be able to know the basics of digital electronics which are used in digital system applications and determine the philosophy of number systems and codes. 2. Students will understand the implementation of different gates. 3. Students will be able to simplify the logic expressions using Boolean laws and postulates and design them by using logic gates and minimize the logic expressions using map method and tabular method. 4. Students will be able to design combinational logic circuits using conventional gates
EE 226	Digital Electronics Lab	1. Design basic logic gates and their realization using universal logic gates(NOR & NAND 2. Analyze SOP & POS and design digital combinational circuits like decoders, encoders, including arithmetic circuits (half adder, full adder, and multiplier 3. Design ripple adder/ Subtractor, multiplexer and demultiplexer and their realization using basic logic gates. 4. Design the seven segment displays. 5. Design sequential digital circuits like flipflops, registers, counters.
EE 228	Measurement Lab	1. Student will be able to measure the AC and DC electrical quantities(voltage, current and energy) 2. Measurement of single and three phase ac power

		3. Calibrate the voltmeter, ammeter by the help of potentiometer 4. Measurement of earth resistance 5. Measure the value of capacitance and inductance by the help of different type of bridges 6. Identify the error in any measurement done and how to minimize it.
EE 231	Analog Electronics Lab	1. Student will be able to analyse continuous time signals & systems 2. Apply Laplace transforms techniques. 3. Apply network theorems practically. 4. Evaluation of Electronic Devices.
EE 232	Electrical Machine- II Lab	1. Students can now apply the knowledge of AC machines in testing them for the study of speed control, efficiency calculation and their various characteristics. 2. Can design and develop new machines. 3. Design the machines for environmental friendly. Can used Modern tools for control.
EE 233	Electrical Machine-I Lab	1. Apply the knowledge about the machines in the field 2. Students can now apply the knowledge of DC machines in testing them for the study of speed 3. control, efficiency calculation and their various characteristics. 4. Students can now apply the knowledge of transformer to testing them for the study of efficiency 5. calculation and their various characteristics.

EE 234	Power Electronics Lab	1. Understand the practical response of various Power electronic components. 2. Understand the practical response of various Electronic firing circuits when working together. 3. Through project development, students will be able to design, develop and implement Electrical wiring. 4. Use various single-phase and three-phase converters in different applications, one of them being “Speed Control of DC motor”.
EE 235	Electrical circuit design Lab	1. Analyse continuous time signals & systems 2. Apply Laplace transforms techniques. 3. Apply network theorems practically. 4. Evaluation of two port networks 5. Analyse positive real functions 6. Solve some simple and some complex electrical circuits with the help of network theorems and transform techniques.
EE 301	Electrical Materials	1. Students will now be able to use the properties and behavior of different materials. 2. Apply the knowledge about the Electrical Engineering Materials to use them more 3. effectively. 4. Become familiar with the dielectric behavior in static as well as varying field and 5. polarization mechanisms. 6. Fulfill the demand of the industry about the analysis and construction of Electrical
EE 303	Power System -I	1. Perform reliability analysis on electrical systems.

		2. Evaluate possible sources of unreliability in the system and its possible causes. 3. Perform analysis using the Reliability concept for systems under study. 4. Plan an electrical system with proper reliability analysis while taking into consideration the future loads. 5. Evaluate Reliability of different components of Power System in industry, like Static Generating Capacity, Spinning Generating Capacity and Transmission Capacity.
EE 305	Control System	1. Identify basic open-loop and closed-loop control systems, and determine their transfer function by various techniques given. 2. Predict the stability of a given system by using techniques like Routh-Hurwitz criterion, Nyquist plots, etc. 3. Determine time response and frequency response analysis of basic first order and second order systems using standard inputs, and also do transient and steady-state analysis of any given LTI system. 4. Design different types of power factor compensations, and design various types of controllers like P, PI, PID, etc.
EE 306	Power System Protection	1. Design and work on basic Power System Protection devices, like CTs, PTs, Relays and Circuit Breakers. 2. Understand the causes of Over-current in Power System and implement measures to protect system from them. 3. Implement various Protection techniques for different Power System components used in the industry, like - Synchronous Generator, Induction Motor, Bus bars, Transformers and Transmission Line.
EE 307	Microprocessor	1. Understand the concept of Engineering application of optimization. 2. Discuss Graphical interpretation pivotal reduction of general systems of equations.

		3. To understand parameters of linear programming problem and non linear programming. 4. Discuss Single variable and multivariable optimization.
EE 308	Electrical Energy Conversion and Auditing	Understand the current energy scenario and importance of energy conservation. · Understand the concepts of energy management. · Understand the methods of improving energy efficiency in different electrical systems. · Understand the concepts of different energy efficient devices.
EE 309	Electrical Machine Design	1. To design armature and field systems for D.C. machines. 2. To design core, yoke, windings and cooling systems of transformers. 3. To design stator and rotor of induction machines. 4. Students will now be able to design an electrical machine for specified output.
EE 310	Electric Drives	1. Understand and implement basic equations governing the operation of drives. 2. Design converters based on the Electric Motor being used in the Drive. 3. Develop a control scheme for the overall control of the Drive. 4. Able to evaluate the performance of a designed drive and its applications. 5. Calculate the evaluating parameters for Electric Drives. 6. The student will have a better understanding of the applications and trends of Electric Drives in the current industry.

EE 311	Restructured Power System.	1. Understand the need of restructuring of the power industry and the behaviour of affected parties. 2. Understand how the electricity is different from other commodities and how the mathematical tools be used to manage the congestion of the transmission lines using PTDF and LODF. 3. Understand the basics of the methods to determine the electricity price at different nodes. 4. Understand the concept of ancillary services in restructured power systems which are required to run the power system in a smooth manner.
EE 312	Power System Planning.	1. Perform reliability analysis on electrical systems. 2. Evaluate possible sources of unreliability in the system and its possible causes. 3. Perform analysis using the Reliability concept for systems under study. 4. Plan an electrical system with proper reliability analysis while taking into consideration the future loads. 5. Evaluate Reliability of different components of Power System in industry, like Static Generating Capacity, Spinning Generating Capacity and Transmission Capacity.
EE 314	Digital Signal Processing.	
EE 316	Electrical and Hybrid Vehicles.	1. Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals. 2. Explain plug – in hybrid electric vehicle architecture, design and component sizing and the power electronics devices used in hybrid electric vehicles. 3. Analyze various electric drives suitable for hybrid electric vehicles. 4. Discuss different energy storage technologies used for hybrid electric vehicles and their control.

		5. Demonstrate different configurations of electric vehicles and its components, hybrid vehicle configuration by different techniques, sizing of components and design optimization and energy management.
EE 317	Digital Control System	1. Represent the dynamics of any simple mechanical, electrical or analogous system as a state-space equation. 2. Derive the transfer function of any simple state-space model using signal flow graph representation or block diagram representation. 3. Solve any state space equations using State Transition Matrix technique. 4. Determine controllability and observability of any system, and make a system controllable using pole placement technique. 5. Represent any discrete system into difference equations, and solve them using z-transform technique.
EE 331	Power System - I Lab	1. Analyze the performance of transmission lines and relays 2. Calculate the steady-state power flow in a power system. 3. Analyze different types of short-circuit faults which occur in power systems
EE 333	Control System Lab	1. Analyse and understand the practical application of MATLAB Computing Control Software. 2. Apply applications of Defining Systems in TF, ZPK form 3. Check for the stability of a given closed loop system. 4. Plot bode plot for a 2nd order system and find GM and PM. 5. Determine time response and frequency response characteristics of a 2^{nd} order system using various techniques described in theory course.
EE 334	Electric Drives Lab	1. Understand the practical response of various converters and motors.

		2. Understand the practical response of various Electric Drive Systems when working together. 3. Through project development, students will be able to design, develop and implement an Electric Drive System.
EE 335	Microprocessor Lab	1. Students will be able to do programming on 8085 microprocessor. 2. Students will be able to do microprocessor based projects
EE 338	Modelling and simulation lab	1. Apply the theory covered in courses to obtain working simulations of advanced Electrical Engineering circuits. 2. Will be able to use MATLAB/PSCAD for designing of circuits/systems that have been covered in their theoretical topic thus far. 3. Through the project development, students will be able to showcase their skills in modelling an Electrical Engineering/Power System through hardware and software. 4. Do various simulations and calculation of the Power System components in MATLAB, PSCAD, etc. to be used in industry.
EE 401	Wind and Solar Energy Systems.	1. Student will be able to analyse and understand the basic and characteristics of Solar/ PV Cell. 2. Apply applications of Renewable energy sources 3. Apply network theorems practically on Solar system. 4. Evaluation of intensity of sun rays and its usability. 5. Work on most of the devices encountered in a Solar Plant, and also will be able to design some of them.
EE 431	Embedded Systems Lab	1. Understand the concept of embedded systems, their characteristics. 2. Discuss hardware/software partitioning algorithms.

		3. To understand parameters of system design methodology and study of generic synthesis system. 4. Discuss functional partitioning for systems.
EE 433	Advance control system lab	1. Represent the dynamics of any simple mechanical, electrical or analogous system as a state-space equation. 2. Derive the transfer function of any simple state-space model using signal flow graph representation or block diagram representation. 3. Solve any state space equations using State Transition Matrix technique. 4. Determine controllability and observability of any system, and make a system controllable using pole placement technique. 5. Represent any discrete system into difference equations, and solve them using z-transform technique.

Syllabus of

UNDERGRADUATE DEGREE
COURSE

Electrical Engineering

Suresh Gyan Vihar University

Detailed Syllabus
Semester I

Course Title: **PHYSICS**		Course Code	**: PY 103**
Semester	: **I**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **48**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Semiconductor physics

Course Objectives:

- To impart knowledge in basic concepts of physics relevant to engineering applications.
- To Introduce advances in technology for engineering applications

Course Content:

Topic and Contents	Hours	Marks
Physics		
UNIT-1: Interference of light	7	12
Michelson's Interferometer: Production of circular & straight line fringes; Determination of wavelength of light; Determination of wavelength separation of two nearby wavelengths. Optical technology: Elementary idea of anti-reflection coating and interference filters.		
UNIT-2: Diffraction and Polarization	8	12
Fraunhofer Diffraction at Single Slit. Diffraction grating: Construction, theory and spectrum; Determination of wavelength of light. Resolving power: Raleigh criterion; Resolving power of diffraction grating and telescope. Plane, circularly and elliptically polarized light on the basis of electric (light) vector: Malus law; Double Refraction; Phase retardation plates and their use in production and detection of circularly and elliptically polarized light; Optical activity and laws of optical rotation; specific rotation and its measurement using half-shade device.		
UNIT-3: **Element of Material science and Quantum Mechanics**	7	12
Bonding in solids; covalent bonding and Metallic bonding; Classification of solids as Insulators, Semiconductors and Conductors; X-Ray diffraction and Bragg's Law. Hall Effect: Theory, Hall Coefficient and applications. Compton effect & quantum nature of light; Derivation of time dependent and time independent Schrodinger's Wave Equation; Physical interpretation of wave function and its properties; boundary conditions; Particle in one dimensional box.		
UNIT-4: Coherence and Optical	7	12

Fibers: Spatial and temporal coherence; Coherence length; Coherence time and 'Q' factor for light; Visibility as a measure of Coherence and spectral purity; Optical fiber as optical wave guide; Numerical aperture; Maximum angle of acceptance and applications of optical fiber.		
UNIT 5: Laser and Holography	7	12
Theory of laser action; Einstein's coefficients; Components of laser; Threshold conditions for laser action; Theory, Design and applications of He-Ne and semiconductor lasers; Holography versus photography, Basic theory of holography; basic requirement of a Holographic laboratory; Applications of Holography in microscopy and interferometry.		
TOTAL	**36**	**60**

Reference:

1. Engineering Physics: Malik and Singh (Tata McGraw Hill)
2. Engineering Physics: Naidu (Pearson)
3. Optics : Ajay Ghatak (Tata McGraw Hill)
4. Concept of Modern Phyiscs: A. Baiser (Tata McGraw Hill)
5. Fundamental of Optics : Jetkins and White (Tata McGraw Hill)
6. Material Science: Smith (McGraw Hill)

Course Outcomes:

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

- To design and conduct simple experiments as well as analyze and interpret data in.
- Capability to understand advanced topics in engineering engineering
- Apply quantum physics to electrical phenomena

Course Title: **MATHEMATICS – I**		Course Code	: **MA 103**
Semester	: **I**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **48**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

- To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
- To introduce the fourier series that is fundamental to application of analysis to Engineering problems.
- To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To familiarize the student with functions of several variables that is essential in most branches of engineering.

Course Content:

Topic and Contents	Hours	Marks
UNIT 1: Calculus	7	12
Improper integrals (Beta and Gamma functions) and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.		
UNIT 2: Sequences and Series	6	12
Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.		
UNIT 3: Fourier Series	7	12
Periodic functions, Fourier series, Euler‟s formula, Change of intervals, Half range sine and cosine series, Parseval‟s theorem.		
UNIT 4: Multivariable Calculus (Differentiation)	8	12
Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.		
UNIT 5: Multivariable Calculus (Integration)	8	12
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.		
TOTAL	**36**	**60**

Reference:

Text Book : Engg. Mathematics-1 by Y.N. Gaur & C.L. Koul

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,

11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Title: **BASIC ELECTRICAL ENGINEERING**	Course Code: **EE 105**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **3:1:0**	Credits : 4 **Credits**
Type of course: **Lecture + Tutorials + Assignments**	Total Contact Hours : **48**
Continuous Internal Evaluation : **40 Marks**	ESE : **60 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

Pre-requisites:

Basics of Mathematics of Higher Secondary Level to include Algebra, Geometry, Trigonometry, Differential and Integral Calculus. Magnetism, Electrostatics and Electromagnetism, Current, Voltage, Electricity. Basic knowledge of semiconductors, Particle and Wave, nature of electromagnetic energy. Use of scientific calculator.

Course Objectives:

- Impart basic knowledge of electrical quantities such as D.C. and A.C. Current voltage, power, energy and frequency.
- Provide working knowledge for the analysis of D.C. and A.C. circuits required for all branches of engineers.
- Develop skills to identify the type of generators and motors required for practical application.
- Highlight importance of transformers and transmission and distribution of electric power.
- Provide knowledge of basic communication systems and different types of transducers
- Design simple electronic circuits.

Course Content:

Topic and Contents	Hours	Marks
UNIT-1**: D.C. Circuits**	7	12
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.		
UNITS-2: A.C Circuits	7	12
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.		
UNITS-3: Transformers	7	12
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.		

UNIT-4: Electrical Machines	7	12
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.		
UNIT 5: Power Converters & Installation Ckt.	8	12
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.		
TOTAL	**36**	**60**

Reference Books

1. Basic Electrical and Electronics Engineering by Sukhija and Nagsarkar, Oxford Publication
2. Basic Electrical & Electronics Engineering by Kothari, Nagrath, TMH
3. Basic Electrical & Electronics Engineering by V. Jagathesan, K. Vinod Kumar & R. Saravan Kumar, Wiley India.
4. Basic Electrical & Electronics Engineering by Prasad/Sivanagraju, Cengage learning Indian Edition
5. Basic Electrical and Electronics Engineering by Muthusubrmaniam, TMH
6. Fundamentals of Electrical and Electronics Engineering by Ghosh, Smarajit, PHI India
7. Basic Electrical & Electronics Engineering by Ravish Singh, TMH
8. Electrical and Electronic Technology by Edward Hughes et al, Pearson Publication
9. Basic Electrical Engineering by A. E. Fitzgerald, TMH
10. Fundamental of Electrical Engineering by Leonard S. Bobrow, Oxford

Course outcomes:

On successful completion of the course, the student will be able to:

- To understand and analyze basic Electric and Magnetic circuits
- To study the working principles of Electrical Machines and Power Converters.
- To introduce components of Low Voltage Electrical Installations

Course Title: **PROGRAMMING FOR PROBLEM SOLVING**		Course Code	: **CP 107**
Semester	: **I**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

This course enables the students to apply the knowledge of Mathematics in various Engineering fields by improving the ability to apply knowledge of mathematics on engineering problems. It introduces the basic concepts required to understand, programming, basic algorithm, branching, loop and pointers.

.**Course Content:**

Topic and Contents	Hours	Marks
UNIT 1: Introduction To Programming	7	12
Introduction to Programming (Flow chart/pseudocode, compilation etc.), Variables (including data types).		
UNIT 2: Conditional Branching And Loops	7	12
Writing and evaluation of conditionals and consequent branching Iteration and loops.		
UNIT 3: Arrays And Basic Algorithm	8	12
Arrays (1-D, 2-D), Character arrays and Strings properties. Searching, Basic Sorting Algorithms, Finding roots of equations, idea of time complexity.		
UNIT 4: Function And Recursion	7	12
Functions (including using built in libraries), Recursion with example programs such as Quick sort, Ackerman function etc		
UNIT 5: Structure And Pointers	7	12
Pointers, Structures (including self referential structures e.g., linked list, notional introduction)		
TOTAL	**36**	**60**

Reference:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course outcomes:

The course will enable the students

- To formulate simple algorithms for arithmetic and logical problems
- To translate the algorithms to programs (in C language)

- To test and execute the programs and correct syntax and logical errors
- To implement conditional branching, iteration and recursion
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach
- To use arrays, pointers and structures to formulate algorithms and programs
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems

Course Title: **ELECTRICAL AND ELECTRONICS ENGINEERING LAB**	Course Code: **EE 151**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

List of Experiments

Note: A minimum of 10 experiments from the following should be performed

1.	Verification of Kirchhoff's laws
2	Verification of (i) Superposition theorem (ii) The Thevenin's Theorem (iii) Maximum Power Transfer Theorem
3	Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4	Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5	Measurement of power in a 3- phase circuit by two wattmeter method.
6	Determination of parameters of ac single phase series RLC circuit.
7	Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
8	To study speed control of dc shunt motor using (i) armature voltage control (ii) field flux control
9	Determination of efficiency of a dc shunt motor by load test.
10	To study input/output characteristics of a BJT.
11	To measure energy by a single phase energy meter and determine error.
12	To study P-N diode characteristics.
13	To study full wave and half wave rectifier circuits with and without capacitor and determine ripple factors
14	To study various logic gates (TTL)
15	. To study Operational Amplifier as Adder and Subtractor

16	To study transistor as a switch
17	To study Function generator and CRO.
18	House Wiring with electric safety measures.

Project: To fabricate a functional electrical/electronic project with a given circuit diagram, using various components soldered on a PCB/Zero PCB. Students should submit project report in a file with headings: objective, principle of working, list of components with cost, circuit diagram, difficulties experienced and conclusion. The project will be evaluated after a presentation given by the students.

Laboratory Outcomes: The students are expected to

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

Course Title: **ENGINEERING PHYSICS LAB**	Course Code**: PY 152**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Lab**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

Course Objectives:

- In this lab students gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- It learns the usage of electrical and optical systems for various measurements.
- It apply the analytical techniques and graphical analysis to the experimental data

Any 10

S. No.	LIST OF PRACTICALS
1	To determine the dispersive power of material of prism
2	To determine the wavelength of sodium light by Newton's rings experiment
3	To determine the specific rotation of glucose / cane sugar solution using polarimeter
4	To determine the wavelength of prominent lines of white light by plane diffraction grating
5	To determine the wavelength of sodium light with the help of Michelson interferometer
6	To study the profile of He-Ne Laser
7	To determine the Numerical Aperture of optical fiber

8	To determine the fringe width and distance between coherent sources by Fresnel's bi-prism experiment
9	To determine the band gap in a semiconductor using a P.N. junction diode
10	To convert a galvanometer into an ammeter.
11	To convert a galvanometer into a voltmeter
12	To draw the plateau characteristic of a Geiger Muller Counter using a radioactive source.
13	To determine the height of an object with the help of sextant
14	To determine high resistance by method of leakage with the help of ballistic galvanometer
15	To determine the specific resistance of a given of a wire with the help of Carry Foster's Bridge

Reference:

1. R. K. Agrawal, Garima Jain Text Book of "Physics practical's" part I, Krishna Publication
2. R. K. Agrawal, Garima Jain Text Book of "Physics practical's" part II, Krishna publication

Laboratory Outcomes:

- Learn basics of instruments and how to calibrate them.
- Develop the circuit design understanding.
- To understand how laser works and its application in fiber communication.
- To understand the operation of semiconductor devices and its applications

Course Title: **PROGRAMMING FOR PROBLEM SOLVING LAB**	Course Code: **CP 153**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

S. No.	**LIST OF PRACTICALS**
1	Problem solving using computers: Lab1: Familiarization with programming environment
2	Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions
3	Branching and logical expressions: Lab 3: Problems involving if-then-else structures
4	Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series
5	1D Arrays: searching, sorting: Lab 5: 1D Array manipulation
6	2D arrays and Strings, memory structure: Lab 6: Matrix problems, String operations
7	Functions, call by value: Lab 7: Simple functions
8, 9	Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Numerical methods problems
10	Recursion, structure of recursive calls: Lab 10: Recursive functions
11	Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures
12	File handling: Lab 12: File operations

Textbooks:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self referential structures.
- To be able to create, read and write to and from simple text files.

Course Title: **ENGINEERING GRAPHICS & DESIGN**	Course Code: **ME 157**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : 2 **Credits**
Type of course: **Labs**	Total Contact Hours : **30**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

S.N.	Contents of the Course

1.	Lines, Lettering, Dimensioning, Scales; Plain Scale, Diagonal Scale (Sheet-1)
2.	To draw curves; Parabola, Hyperbola, Ellipse (Sheet-1)
3.	Projection of Points & Lines; Orthographic Projection- 1st And 3rd Angle Projection, Projection of Surfaces– Hexagon (Sheet-1)
4.	Projection of Solids; Cube, Pyramid, Prism, Cylinder, Cone, Full & Half Sectional Views of Solids (Sheet-1)
5.	To study of AutoCAD 2D cammand: Cartesian and Polar coordinate system, Absolute and Relative coordinates; Basic editing commands: Line, Point, Trace, Rectangle, Polygon, Circle, Arc, Ellipse, , Erase, Display commands: Zoom, Pan, unit, line type, line weight, rayline, Xline
6.	To study of AutoCAD 2D cammand: Polyline, Move, Copy, Offset, Fillet, Chamfer, Trim, Extend, Mirror, break, join, extend, stretch, dimension, text, area, boundary, explode, hatch, filter, layer, block, print
7.	To draw Orthographic Projections drawing using AutoCAD (2 Problems)
8.	To draw Sectional Views using AutoCAD (2 Problems)
9.	To draw assembly drawing of simple machine elements like rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket using AutoCAD (2 Drawing)
10.	To study of AutoCAD 3D cammand: Box, Cylinder, Sphere, Cone,Wedge,Toros,Pyramid,Extrude,Helix,Sweep,Loft,Revolve,Mirror 3D (1 Problems)

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design

Reference:

1. Narayana, K.L. and Kannaiah, P. Text Book of Engineering Drawing"Engineering Graphics", Scitech Publication
2. Bhatt, N.D. "Elementary Engineering Drawing", Charotar Book Stall, Anand, 1998 • Lakshminarayanan, V. and Vaish Wanar, R.S., "Engineering Graphics", Jain Brothers, New Delhi, 1998
3. Chandra, A.M. and Chandra Satish, "Engineering Graphics", Narosa, 1998 • Jolhe, "Engineering Graphics", Tata McGraw-Hill- WBUT Series

Semester II

Course Title: **ENGLISH**		Course Code	**: EN 108**
Semester	: **II**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:0:0**	Credits	: **2 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of English, up-to Senior Secondary School level.

Course Objectives:

- This course develops the ability to understand the role of communication in personal & professional success.
- Develop awareness of appropriate communication strategies and ability to prepare and present messages with a specific intent.
- Analyze and learn variety of communication acts. And ethically use, document and integrate sources.

Course Content:

Topic and Contents	Hours	Marks
UNIT 1: Vocabulary Building	8	12
The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.		
UNIT 2: Basic Writing Skills	7	12
Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely		
UNIT 3: Identifying Common Errors In Writing	7	12
Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés.		
UNIT 4: Nature, Style Of Sensible Writing	7	12
Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion		
UNIT 5: Writing Practice	7	12
Comprehension, Précis Writing, Essay Writing.		
TOTAL	**36**	**60**

Reference:

1. Practical English Usage. Michael Swan. OUP.1995
2. Remedial English Grammar. F.T. Wood Macmillan.2007 (iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006
4. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011
5. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course outcomes:

On successful completion of the course, the student will be able to:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Title: **MATHEMATICS – II**		Course Code	: MA 104
Semester	: **II**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:1:0**	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **48**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
- To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

.**Course Content:**

Topic and Contents	Hours	Marks
UNIT 1: Matrices	8	12
Rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.		
UNIT 2: First Order Ordinary Differential Equations	7	12
Linear and Bernoulli‟s equations, Exact equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut‟s type.		
UNIT 3: Ordinary Differential Equations of Higher Orders	8	12
Linear Differential Equations of Higher order with constant coefficients, Simultaneous Linear Differential Equations, Second order linear differential equations with variable coefficients: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters, CauchyEuler equation; Power series solutions		

including Legendre differential equation and Bessel differential equations.		
UNIT 4: Partial Differential Equations	6	12
First order: Order and Degree, Formation; Linear Partial differential equations of First order, Lagrange‟s Form, Non Linear Partial Differential equations of first order, Charpit‟s method, Standard forms.		
UNIT 5: Partial Differential Equations	7	12
Higher order: Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.		
TOTAL	**36**	**60**

Reference:

1. D. Poole, “Linear Algebra: A Modern Introduction”, Brooks/Cole, 2005.
2. N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2008.
3. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2010.
4. V. Krishnamurthy, V. P. Mainra and J. L. Arora, “An introduction to Linear Algebra”, Affiliated East-West press, 2005.

Course outcomes:

On completion of this course, students are able

- Understand the design and analysis of continuous and discrete systems with the help of Fourier series and Harmonic analysis.
- Interpret the concept of rank of a matrix and apply it to solve the system of linear algebraic equations.
- Examine and recognize the use of Eigen values and Eigen vectors in various Complex Engineering Problems.
- Understand the concept of solid geometry (Sphere, Cone, and Cylinder) which arises in electromagnetic field theory, CAD-CAM, Computer graphics.
- To introduce the concept of Vector differentiation and integration that finds applications in various fields like solid mechanics, fluid flow, heat problems and potential theory.

Course Title: **CHEMISTRY**		Course Code	: **CY 102**
Semester	: **II**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	ESE	: **60 Marks**
Programmes: **B.Tech (All)**			

Pre-requisites:

Knowledge of Mathematics, up-to Senior Secondary School level.

Course Objectives:

- To encourage basic engineering materials which are useful for different engineering and technology such as of Chemistry and knowledge is added
- To develop knowledge by teaching and modeling for engineering Materials
- Knowledge dissemination for Engineering by Chemicals and Materials
- Advanced materials are also the objective for Students
- Apply the concept of materials and Chemicals used to solve the engineering materials in different engineering field.
- Apply the processing in solving the problems of required materials.
- Solve the problem of advanced materials used the civil engineering computer science (memory materials) electrical ,EC Mechanical , VLSI using concepts of different properties.
- Evaluate the advanced engineering materials such as communication, networking high temperature using structures of chemicals.
- Apply and evaluate different concept in development and innovation in engineering field.
- Innovate new materials to solve basic concept of various technology.

Course Content:

Topic and Contents	Hours	Marks
UNIT 1: Atomic And Molecular Structure	8	12
Schrodinger equation. Particle in box solutions and their applications for conjugated molecules and nano particles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbital of diatomic molecules and plots of the multi-centre orbital. Equations for atomic and molecular orbital. Energy level diagrams of diatomic. Pi-molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.		
UNIT 2: Spectroscopic Techniques And Applications	7	12
Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.		
UNIT 3: Intermolecular Forces And Potential Energy Surfaces Rays And Basic Algorithm, Use Of Free Energy In Chemical Equilibrium	8	12

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces . Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibrium. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.		
UNIT 4: Periodic Properties And Stereochemistry	7	12
Effective nuclear charge, penetration of orbital, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.		
UNIT 5: Organic Reactions And Synthesis Of Drug Molecule	6	12
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.		
TOTAL	**36**	**60**

Reference:

1. B. H. Mahan, "University chemistry", Addison-Wesley Publishing Company, 1975.
2. M. J. Sienko and R. A. Plane, "Chemistry: Principles and Applications", McGraw Hill International, 1974.
3. C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw Hill Education, 1994.
4. B. L. Tembe, Kamaluddin and M. S. Krishnan, "Engineering Chemistry" (NPTEL).
5. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry: Structure and Function" Freeman, 2010.

Course outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyze microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations.

- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

Course Title: **BASIC ELECTRONIC ENGINEERING**	Course Code: **EC 106**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **3:0:0**	Credits : 3 **Credits**
Type of course: **Lecture + Tutorials + Assignments**	Total Contact Hours : **36**
Continuous Internal Evaluation : **40 Marks**	SEE : **60 Marks**
Programmes:	

Pre-requisites:

Semiconductor physics

Course Objectives:

- Impart basic knowledge of electronics quantities such as diode and transistors.
- Provide working knowledge of Transistor and Junction Diode for all branches of Engineering..
- Develop skills to identify the type of electronics in digital and analog system.
- Highlight importance of Communication system and Digital Electronics System.
- Design simple electronic circuits with Transistor and Junction.

Topic and Contents	Hours	Marks
UNIT 1: Semiconductor Devices and Applications	8	12
Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.		
UNIT 2: Operational Amplifier And Its Applications	7	12
Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.		
UNIT 3: Timing Circuits And Oscillators	6	12

RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.		
UNIT 4: Digital Electronics Fundamentals	8	12
Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.		
UNIT 5: Electronic Communication Systems	7	12
The elements of communication system, IEEE frequency spectrum, and Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.		
TOTAL	**36**	**60**

Reference:

1. Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.
2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001.

Course Outcomes:

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

- Understand the principles of semiconductor devices and their applications.
- Design an application using Operational amplifier.
- Understand the working of timing circuits and oscillators.
- Understand logic gates, flip flop as a building block of digital systems.
- Learn the basics of Communication system.

Course Title: **CHEMISTRY LAB**	Course Code: **CY 152**
Semester : **I**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

S. No.	LIST OF PRACTICALS
1	Determination of surface tension and viscosity
2	Thin layer chromatography
3	Ion exchange column for removal of hardness of water

4	Determination of chloride content of water
5	Colligative properties using freezing point depression
6	Determination of the rate constant of a reaction
7	Determination of cell constant and conductance of solutions
8	Potentiometry - determination of redox potentials and emfs.
9	Synthesis of a polymer/drug
10	Saponification/acid value of an oil
11	Chemical analysis of a salt
12	Lattice structures and packing of spheres
13	Models of potential energy surfaces
14	Chemical oscillations- Iodine clock reaction
15	Determination of the partition coefficient of a substance between two immiscible liquids
16	Adsorption of acetic acid by charcoal
17	Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg

Reference:

1. ogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney
2. Applied Chemistry: Theory and Practice (Latest ed.), By O.P. Vermani & A.K. Narula.
3. Practical Physical Chemistry (Latest ed.), By B.D. Khosla, A. Gulati & V.C. Garg
4. Laboratory Manual on Engineering Chemistry (Latest ed.), By S.K. Bhasin and Sudha Rani

Laboratory Outcomes:

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn to Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyze a salt sample

Course Title: **ENGLISH LANGUAGE LAB**	Course Code: **EN 152**
Semester : **II**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:2**	Credits : 1 **Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

S. No.	**LIST OF PRACTICALS**
1	Listening Comprehension

2	Pronunciation, Intonation
3	Stress and Rhythm
4	Common Everyday Situations: Conversations and Dialogues
5	Communication at Workplace
6	Interviews
7	Formal Presentations

Course Title: : **WORKSHOP MANUFACTURING PRACTICES**	Course Code: **ME 158**
Semester : **II**	Core / Elective: **Program Core**
Teaching Scheme in Hrs (L:T:P) : **0:0:3**	Credits : **2 Credits**
Type of course: **Labs**	Total Contact Hours : **20**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

Manufacturing is fundamental to the development of any engineering product. This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included. The course intends to prepare students for:

- Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications
- The selection of a suitable technique for meeting a specific fabrication need
- Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Objectives:

- Introduction to different manufacturing methods in different fields of engineering
- Practical exposure to different fabrication techniques
- Creation of simple components using different materials
- Exposure to some of the advanced and latest manufacturing techniques being employed in the industry

S.N.	Contents of the Course
1.	To study different types of measuring tools used in workshop and determine least counts of vernier calipers, micrometers and vernier height gauges.
2.	To prepare a multi-operation job on a lathe involving facing, turning, step turning, chamfering & knurling

3.	To prepare horizontal surface/ vertical surface/ slots or V-grooves on a shaper/planner machine.
4.	To study different types of fitting tools and marking tools used in fitting shop.
5.	To prepare a model in fitting shop and make hole using drilling machine.
6.	To study various types of carpentry tools and type of pattern.
7.	To prepare two wooden joints; Lap & Bridle Joint
8.	To prepare a mould cavity by using a solid / single piece pattern.
9.	To prepare melting pouring and making an aluminium casting
10.	To prepare at least two welding joints; Butt/ Lap/T-Joint/ Corner Joint by arc welding

Laboratory Outcomes

- Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.
-

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Course Title: : **EMPLOYABILITY SKILLS – I**	Course Code: **EM-102**
Semester : **II**	Core / Elective: **University Core**
Teaching Scheme in Hrs (L:T:P) : **2:0:0**	Credits : **1 Credits**
Type of course: **Labs**	Total Contact Hours : **25**
Continuous Internal Evaluation : **60 Marks**	ESE : **40 Marks**
Programmes: **Common to all B. Tech. Engineering Programmes**	

S.No.	Topic	Details	Contact Hrs
1	Motivation	Orientation for all & Importance of Soft Skills & Confidence in Business	1
2	Communication	Basics, Introduction, Barriers in Communication, Types, Verbal, Non-verbal, Face/Eye/Body Language, Interview Skills &Types	15
3	Attitude& Manners	Grooming & Etiquettes, Vales & Ethics, What is personality, Good Human Being, Confidence Building	9

2nd Year - III Semester: B.Tech. (Electrical Engineering)

Power Generation Processes

Credit: 3 **Max. Marks: 100 (IA:40, ETE:60)**

3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1.	**Conventional Energy Generation Methods** Thermal Power plants: Basic schemes and working principle. (ii) Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes. Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. (iv) Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.	6
2.	**New Energy Sources** Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming).Renewable and nonrenewable energy sources. Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction to electric energy generation by wind, solar and tidal. **Loads and Load Curves** Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization.	8
3.	**Power Factor Improvement** Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers. **Selection of Power Plants** Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants.	8

4.	**Power Plant Economics** Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics. Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction: off peak energy utilization, co-generation, and energy conservation.	**6**
5	**Tariff** Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three part tariff. Spot (time differentiated) pricing.	**6**
	Total	**36**

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6

				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

SURESH GYAN VIHAR UNIVERSITY
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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

2nd Year - III Semester: B.Tech. (Electrical Engineering)

Electrical Circuit Analysis

Credit: 4 **Max. Marks: 100 (IA:40, ETE:60)**
4L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1.	**Network Theorems** Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.	6
2.	**Solution of First and Second order networks** Solution of first and second order differential equations for Series and parallel R-L, R-C, RL- C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.	8
3.	**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. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.	8
4.	**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. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances	6
5.	**Two Port Network and Network Functions** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.	6
	TOTAL	**36**

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12

1	S	S	S	S	S	S	S	S	S	S	S	S

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Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25

3	Analysis and Evaluation	40

Analog Electronics

Credit: 3 **Max. Marks: 100 (IA:40, ETE:60)**

3L+0T+0P **End Term Exam: 3 Hours**

SN		Hours
1.	**Diode circuits** P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.	6
2.	**BJT circuits** Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.	8
3.	**MOSFET circuits** 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, transconductance, high frequency equivalent circuit.	8
4.	**Differential, multi-stage and operational amplifiers** 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)	6
5.	**Linear applications of op-amp** Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. **Nonlinear applications of op-amp** Hysteretic Comparator, Zero Crossing Detector, Square-wave and	6

	triangular-wave generators, Precision rectifier, peak detector. Monoshot	
		TOTAL **36**

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

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Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Electrical Machine-I

Credit: 4 **Max. Marks: 100 (IA:30, ETE:120)**

3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1.	**Magnetic fields and magnetic circuits** Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.	8
2.	**Electromagnetic force and torque** B-H curve of magnetic materials; flux-linkage v/s current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency	8

3.	**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.	**12**
4.	**DC machine - motoring and generation** Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed.	**12**
5	**DC machine – Analysis** V-I characteristics and torque- speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines.	**8**
Total		**48**

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9

		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Electromagnetic Fields

Credit: 2 **Max. Marks: 100 (IA:40, ETE:60)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	CONTENTS	Hours
1.	**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 operatordel, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.	4
2.	**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.	4
3.	**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.	4
4.	**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.	6

5.	**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. Boundary Conditions. **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.	**6**
	TOTAL	**24**

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

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Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASS	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course

	End of Course survey		End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

2nd Year - III Semester: B.Tech. (Electrical Engineering)

Analog Electronics Lab

Credit: 1 **Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+2P

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

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

2nd Year - III Semester: B.Tech. (Electrical Engineering)

Electrical Machines-I Lab

Credit: 1 **Max. Marks: 100**
(IA:60, ETE:40) 0L+0T+2P

1) To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency.
2) To perform sumpner's test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit.
3) To determine the efficiency and voltage regulation of a single-phase transformer by direct loading.
4) To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit.
5) To perform the parallel operation of the transformer to obtain data to study the load sharing.
6) Separation of no load losses in single phase transformer.
7) To study conversion of three-phase supply to two-phase supply using Scott- Connection.
8) Speed control of D.C. shunt motor by field current control method & plot the curve for speed verses field current.
9) Speed control of D.C. shunt motor by armature voltage control method & plot the curve for speed verses armature voltage.

10) To determine the efficiency at full load of a D.C shunt machine considering it as a motor by performing Swinburne's test.

11) To perform Hopkinson's test on two similar DC shunt machines and hence obtain their efficiencies at various loads.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Electrical Circuit Design Lab

Credit: 1 **Max. Marks: 100**

(IA:60, ETE:40) 0L+0T+2P

1) Introduction to Datasheet Reading.
2) Introduction to Soldering - Desoldering process and tools.
3) Simulate characteristic of BJT and UJT. Validate on Bread Board or PCB.
4) Simulate Bridge Rectifier Circuit and validate on Bread Board or PCB.
   a) Half Bridge.
   b) Full Bridge.
5) Simulate Regulated Power Supply and validate on Bread Board or PCB.
   a) Positive Regulation (03 Volt to 15 Volt).
   b) Negative Regulation (03 Volt to 15 Volt).
   c) 25 Volt, 1–10 A Power Supply.
6) Simulate Multivibrator circuit using IC 555 and BJT separately. Validate on Bread Board or PCB.
   a) Astable Mode.
   b) Bistable Mode.
   c) Monostable Mode.
7) Introduction to Sensors to measure real time quantities and their implementation in different processes.
   (Proximity, Accelerometer, Pressure, Photo-detector, Ultrasonic Transducer, Smoke,

Temperature, IR, Color, Humidity, etc.).

8) Hardware implementation of temperature control circuit using Thermistor.

9) Simulate Frequency divider circuit and validate it on Bread Board or PCB.

10) Hardware implementation of 6/12 V DC Motor Speed Control (Bidirectional)

11) Simulate Buck, Boost, Buck-Boost circuit and validate on Bread Board or PCB.

12) Simulate Battery Voltage Level Indicator Circuit and validate on Bread Board or PCB.

12) Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

13)

14) S: Strong relationship M: Moderate relationship

15) Course Assessment and Evaluation:

16) The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASS	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course

	End of Course survey		End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

17) **CIE** – Continuous Internal Evaluation **ESE** –End Semester Examination

18)

Composition of Educational Components:

19)

20) Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

21)

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Syllabus of

UNDERGRADUATE DEGREE COURSE

Electrical Engineering

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

2nd Year - III Semester: B.Tech. (Electrical Engineering)

SURESH GYAN VIHAR UNIVERSITY

Effective from session: 2020 – 2021

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Electronic Measurement and Instrumentation

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**
2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Measuring Instruments:** Moving coil, moving iron, electro-dynamic and induction instruments-construction, operation, torque equation and errors. Applications of instruments for measurement of current, voltage, single-phase power and single-phase energy. Errors in wattmeter and energy meter and their compensation and adjustment. Testing and calibration of single-phase energy meter by phantom loading.	4
2	**Polyphase Metering:** Blondel's Theorem for n-phase, p-wire system. Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems: One-wattmeter, two- wattmeter and three-wattmeter methods. 3-phase induction type energy meter. Instrument Transformers: Construction and operation of current and potential transformers. Ratio and phase angle errors and their minimization. Effect of variation of power factor, secondary burden and frequency on errors. Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy.	6
3	**Potentiometers:** Construction, operation and standardization of DC potentiometers– slide wire and Crompton potentiometers. Use of potentiometer for measurement of resistance and voltmeter and ammeter calibrations. Volt ratio boxes. Construction, operation and standardization of AC potentiometer in-phase and quadrature potentiometers. Applications of AC potentiometers.	5
4	**Measurement of Resistances:** Classification of resistance. Measurement of medium resistances – ammeter and voltmeter method, substitution method, Wheatstone bridge method. Measurement of low resistances – Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Price's Guard- wire method. Measurement of earth resistance.	6
5	**AC Bridges:** Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge and Anderson bridge for self-inductance measurement. Heaviside's bridge for mutual inductance measurement. De Sauty Bridge for capacitance measurement. Wien's bridge for capacitance and frequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components. Wagner earth device.	6
	Total	**36**

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Electrical Machines – II

Credit: 4 **Max. Marks: 100 (IA:40, ESE:60)**
3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Fundamentals of AC machine windings** Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor.	8
2	**Pulsating and revolving magnetic fields** Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.	8
3	**Induction Machines** Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.	12
4	**Single-phase induction motors** Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications.	8
5	**Synchronous machines** Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine – two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.	12
	Total	**48**

SURESH GYAN VIHAR UNIVERSITY
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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Power Electronics

Credit: 4 **Max. Marks: 100 (IA:40, ESE:60)**
3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Power switching devices** Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.	8
2	**Thyristor rectifiers** Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.	8
3	**DC-DC buck converter** Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. **DC-DC boost converter** Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage	12
4	**Single-phase voltage source inverter** Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage.	12
5	**Three-phase voltage source inverter** Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation.	8
	Total	**48**

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Signals and Systems

Credit: 3
2L+1T+0P

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DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Max. Marks: 100(IA:40, ESE:60)
End Term Exam: 3 Hours

SN	CONTENTS	Hours
1	**Introduction to Signals and Systems:** Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.	**8**
2	**Behavior of continuous and discrete-time LTI systems:** Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	**8**
3	**Fourier, Laplace and z- Transforms:** Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality.	**8**
4	**The Discrete-Time Fourier Transform (DTFT)** and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	**10**

5	**Sampling and Reconstruction:** The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	**12**
	Total	**36**

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Digital Electronics

Credit: 4 **Max. Marks: 100(IA:40, ESE:60)**
3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Fundamentals of Digital Systems and logicfamilies:** 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.	8
2	**Combinational DigitalCircuits:** 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, Q-M method of function realization.	8
3	**Sequential circuits and systems:** A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.	8
4	**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	12

5	**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).	**12**
	Total	**48**

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Electrical Machines - II Lab

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**
0L+0T+2P

1) To study various types of starters used for 3 phase induction motor.
2) To connect two 3-phase induction motor in cascade and study their speed control.
3) To perform load test on 3-phase induction motor and calculate torque, output power, input power, efficiency, input power factor and slip for various load settings.
4) To perform no load and blocked rotor test on a 3-phase induction motor and determine the parameters of its equivalent circuits.
5) Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv) p. f. (v) Efficiency.
6) Speed control of 3- Φ Induction Motor
7) To plot the O.C.C. & S.C.C. of an alternator.
8) To determine Zs , Xd and Xq by slip test, Zero power factor (ZPF)/ Potier reactance method.
9) To determine the voltage regulation of a 3-phase alternator by direct loading.
10) To determine the voltage regulation of a 3-phase alternator by synchronous impedance method.
11) To study effect of variation of field current upon the stator current and power factor of synchronous motor andPlot V-Curve and inverted V-Curve of synchronous motor for different values of loads.
12) To synchronize an alternator across the infinite bus and control load sharing.

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Power Electronics Lab

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**
0L+0T+2P

1) Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT.
2) Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.
3) Find V-I characteristics of TRIAC and DIAC.
4) Find output characteristics of MOSFET and IGBT.
5) Find transfer characteristics of MOSFET and IGBT.
6) Find UJT static emitter characteristics and study the variation in peak point and valley point.
7) Study and test firing circuits for SCR-R, RC and UJT firing circuits.
8) Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters.
9) Study and obtain waveforms of single-phase half wave controlled rectifier with and without filters. Study the variation of output voltage with respect to firing angle.
10) Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode.
11) Study and obtain waveforms of single-phase full controlled bridge converter with R and RL loads. Study and show rectification and inversion operations with and without freewheeling diode.

12) Control the speed of a dc motor using single-phase half controlled bridge rectifier and full controlled bridge rectifier. Plot armature voltage versus speed characteristics.

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING
2nd Year B.Tech. Electrical Engineering

Digital Electronics Lab

Credit: 1 **ax. Marks: 100(IA:60, ESE:40)**
0L+0T+2P

1) To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates with 2, 3, & 4 inputs).
2) To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND & NOR gates.
3) To realize an SOP and POS expression.
4) To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.
5) To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor & basic Full Adder/ Subtractor.
6) To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer.
7) Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven segment display.
8) Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.
9) Construct a divide by 2,4& 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10) Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of

multiple values into the register using multiplexer.

Credit: 1 **Measurement Lab**
0L+0T+2P **Max. Marks: 100(IA:60, ETE:40)**

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

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Syllabus of UNDERGRADUATE DEGREE COURSE

B.Tech. V Semester

Electrical Engineering

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SURESH GYAN VIHAR UNIVERSITY

Effective from session: 2020 – 2021

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

ELECTRICAL MATERIALS

Credit: 2 **Max. Marks: 100(IA:40, ESE:60)**

2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Elementary Materials Science Concepts** Bonding and types of solids, Crystalline state and their defects, Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall effect..	02
2	**Dielectric Properties of Insulators in Static and Alternating field:** Dielectric constant of mono-atomic gases, poly-atomic molecules and solids, Internal field in solids and liquids, Properties of Ferro-Electric materials, Polarization, Piezoelectricity, Frequency dependence of Electronic and Ionic Polarizability, Complex dielectric constant of non-dipolar solids, dielectric losses.	07
3	**Magnetic Properties and Superconductivity** Magnetization of matter, Magnetic Material Classification, Ferromagnetic Origin, Curie-Weiss Law, Soft and Hard Magnetic Materials, Superconductivity and its origin, Zero resistance and Meissner Effect, critical current density.	05
4	**Conductivity of metals** Ohm's law and relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals.	04
5	**Semiconductor Materials:** Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, Trends in materials used in Electrical Equipment.	04
	TOTAL	24

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

POWER SYSTEM - I

Credit: 4 **Max. Marks: 100(IA:40, ESE:60)**

3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Basic Concepts** Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.	8
2	**Power System Components:** Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. ParamESErs of lines and cables. Capacitance and Inductance calculations for simple configurations. Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines. Transformers: Three-phase connections and Phase-shifts. Three-winding transformers, autotransformers, Neutral Grounding transformers. Tap-Changing in transformers. Transformer ParamESErs. Single phase equivalent of three-phase transformers. Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations.	12
3	**Over-voltages and Insulation Requirements** Generation of Over-voltages: Lightning and Switching Surges. Protection against Overvoltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams.	8

4	**Fault Analysis and Protection Systems** Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding**.** Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.	**12**
5	**Introduction to DC Transmission & Renewable Energy Systems** DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators. Power Electronics interfaces of wind generators to the grid	**8**
	TOTAL	**48**

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Course Title: **CONTROL SYSTEMS**		Course Code	: EE 307
Semester	: V	Core / Elective	: CORE
Teaching Scheme in Hrs (L:T:P)	: **3:0:0**	Credits	: **3 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **36**
Continuous Internal Evaluation	: **40 Marks**	SEE	: **60 Marks**
Programmes: **B.Tech Electrical Engineering + Dual Degree 3,5**			

Pre-requisites:

Engineering Physics & Circuit Theory

Course Objectives:

1. Concept of Linear vector space Linear Independence
2. Modern Vs conventional control theory, concept of state, state variable state vector,
3. State space representation using canonical variables. Diagonal matrix. Jordan canonical form, Derivation of transfer function from state-model
4. Pole placement by state feedback, Ackerman's formula.
5. The Z-transform, Z-Transfer Function. Block diagram analysis of sampled data systems, Z and S domain relationship, digital PID controller
6. Make students familiar with the basic ideas of open and closed loop control systems, their stability and controllability, and various methods of controlling a system.

SN	CONTENTS	HOURS
1	**Introduction to control problem** Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra	6
2	**Time Response Analysis:** Standard test signals. Time response of first and second order sys- tems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.	6
3	**Frequency-response analysis** Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.	8

4	**Introduction to Controller Design** Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers	**8**
5	**State variable Analysis** Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems **Introduction to Optimal Control and Nonlinear Control** Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis	**8**
	TOTAL	**36**

Reference:

1) I J Nagrath and M Gopal: Control systems Engineering, 3rd Ed, New Age Publication.
2) K. Atsuhiko Ogata: Modern control engineering. PRENTICE HALL OF INDIA.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Identify basic open-loop and closed-loop control systems, and determine their transfer function by various techniques given.
2. Predict the stability of a given system by using techniques like Routh-Hurwitz criterion, Nyquist plots, etc.
3. Determine time response and frequency response analysis of basic first order and second order systems using standard inputs, and also do transient and steady-state analysis of any given LTI system.
4. Design different types of power factor compensations, and design various types of controllers like P, PI, PID, etc.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What	To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes

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DEPARTMENT OF ELECTRICAL ENGINEERING

DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 TO 4
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	1 TO 5
		Graded Assignments		Two Assignments	10	Log of record	1 TO 4
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 TO 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 5, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

MICROPROCESSOR

Credit: 3 **Max. Marks: 100 (IA:40, ESE:60)**

2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Fundamentals of Microprocessors** Fundamentals of Microprocessor Architecture. 8-bitMicroprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.	6
2	**The 8051 Architecture:** Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.	6
3	**Instruction Set and Programming** Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools..	8
4	**Memory and I/O Interfacing** Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.	8
5	**External Communication Interface** Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. **Applications** LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing	8
	TOTAL	36

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

ELECTRICAL MACHINE DESIGN

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**

2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Major Consideration for Design** Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.	6
2	**Transformers:** Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers	6
3	**Induction Motors** Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.	08
4	**Synchronous Machines** Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature de- sign, armature paramESErs, estimation of air gap length, design of ro- tor, design of damper winding, dESErmination of full load field mmf, design of field winding, design of turbo alternators, rotor design.	08
5	**Computer aided Design (CAD):** Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.	08
	TOTAL	36

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

RESTRUCTURED POWER SYSTEM

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**

2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction to restructuring of power industry** Reasons for restructuring of power industry; Understanding the re-structuring process, Entities involved, The levels of competition, The market place mechanisms, Sector-wise major changes required; Reasons and objectives of deregulation of various power systems across the world	6
2	**Fundamentals of Economics** Consumer and suppliers behavior, Total utility and marginal utility, Law of diminishing marginal utility, Elasticity of demand and supply curve, Market equilibrium, Consumer and supplier surplus, Global welfare, Deadweight loss	6
3	**The Philosophy of Market Models** Monopoly model, Single buyer model, Wholesale competition model, Retail competition model, distinguishing features of electricity as a commodity, Four pillars of market design, Cournot, Bertrand and Stackelberg competition model	8
4	**Transmission Congestion Management** Transfer capability, Importance of congestion management, Ef- fects of congestion, Classification of congestion management me- thods, ATC, TTC, TRM, CBM, ATC calculation using DC and AC model, Nodal pricing, Locational Marginal Prices (LMPs), Implications of nodal pricing, Price area congestion management Capacity allevia- tion methods, Re-dispatching, Counter-trade, Curtailment	8
5	**Ancillary Service Management** Type and start capability service, Provisions of ancillary services, Markets for ancillary services, Co-optimization of energy and reserve services, Loss of opportunity cost, International practices of ancillary services. **Pricing of transmission network usage and Market power** Introduction to transmission pricing, Principles of transmission pricing, Classification of transmission pricing, Rolled-in transmission pricing paradigm. Attributes of a perfectly competitive market, The firm's supply decision under perfect competition, Imperfect competi-tion, Monopoly, Oligopoly. Effect of market power, Identifying market power, HHI Index, Entropy coefficient, Lerner index.	8
		36

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

ELECTROMAGNETIC WAVE

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**

2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Transmission Lines** Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmis- sion line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.	6
2	**Maxwell's Equations** Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surfacecharge and surface current, Boundary conditions at media interface.	6
3	**Uniform Plane Wave** Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave pola- rization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.	8
4	**Plane Waves at Media Interface** Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.	8
5	**Waveguides** Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide- general approach, Rectangular waveguides. **Antennas** Radiation paramESErs of antenna, Potential functions, Solution for po- tential functions, Radiations from Hertz dipole, Near field, Far field, Total power ra- diated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz di- pole in receiving mode.	8
	TOTAL	36

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

DIGITAL CONTROL SYSTEM

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**

2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Discrete Representation of Continuous Systems** Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.	4
2	**Discrete System Analysis** Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.	4
3	**Stability of Discrete Time System** Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.	8
4	**State Space Approach for discrete time systems** State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.	8
5	**Design of Digital Control System** Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator. **Discrete output feedback control** Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems	12
	Total	

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

POWER SYSTEM - I LAB

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**

0L+0T+2P **End Term Exam: 3 Hours**

1) Generating station design: Design considerations, basic schemes and single line dia- gram of hydro, thermal, nuclear and gas power plants. Electrical equipment for power stations.
2) Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin's law.
3) Study of short term, medium term and long term load forecasting.
4) Sending end and receiving end power circle diagrams.
5) Substations: Types of substations, various bus–bar arrangements. Electrical equip- ment for substations.
6) Study high voltage testing of electrical equipment: line insulator, cable, bushing, pow- er capacitor, and power transformer.
7) Design an EHV transmission line
8) Study filtration and Treatment of transformer oil.
9) DESErmine dielectric strength of transformer oil.
10) DESErmine capacitance and dielectric loss of an insulating material using Schering bridge.

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

CONTROL SYSTEM LAB

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**

0L+0T+2P **End Term Exam: 3 Hours**

1. (a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and w_n natural undamped frequency.

   (b) Plot ramp response.

2. To design 1st order R-C circuits and observe its response with the following inputs and trace the curve.
   (a) Step
   (b) Ramp (c) Impulse

3. To design 2nd order electrical network and study its transient response for step input and following cases.
   (a) Under damped system
   (b) Over damped System.
   (c) Critically damped system.

4. To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies.
   (a) Leg Network
   (b) Lead Network. (c) Leg-lead Network.

5. Draw the bode plot in real time for a Non-Inverting amplifier.

6. Draw the bode plot in real time for an Inverting amplifier.

7. Draw the bode plot for second order transfer function.

8. Draw the bode plot for first order transfer function.

9. Design and analyse Tow- Thomas biquad filter.

10. Design and calculate Kp, Ki for PI controller.

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

MICROPROCESSOR LAB

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**

0L+0T+2P **End Term Exam: 3 Hours**

1. Study the hardware, functions, memory structure and operation of 8085-Microprocessor kit.
2. Program to perform integer division: (1) 8-bit by 8-bit (2) 16-bit by 8-bit.
3. Transfer of a block of data in memory to another place in memory
4. Transfer of black to another location in reverse order.
5. Searching a number in an array.
6. Sorting of array in: (1) Ascending order (2) Descending order.
7. Finding party of a 32-bit number.
8. Program to perform following conversion (1) BCD to ASCII (2) BCD to hexadecimal.
9. Program to multiply two 8–bit numbers
10. Program to generate and sum 15 Fibonacci numbers.
11. Program for rolling display of message “India”, “HELLO”.
12. To insert a number at correct place in a sorted array.
13. Reversing bits of an 8-bit number.
14. Fabrication of 8-bit LED interfaces for 8085 kit through 8155 and 8255.
15. Data transfer on output port 8155 & 8255 & implementation of disco light, running light, and sequential lights on the above mentioned hardware.
16. Parallel data transfer between two DYNA-85 kit using 8253 ports.
17. Generation of different waveform on 8253/8254 programmable timer.

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

SYSTEM PROGRAMMING LAB

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**

0L+0T+2P **End Term Exam: 3 Hours**

1. Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs, scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects, Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets)
2. Write a MATLAB program for designing Rheostat.
3. Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets)
4. Write a program to generate Machine Op- code table using two pass Assembler.
5. Single Phase Full Wave Diode Bridge Rectifier With LC Filter
6. Simulate Three phase Half wave diode rectifier with RL load.
7. Starting Of A 5 HP 240V DC Motor With A Three-Step Resistance Starter.
8. Simulate OC/SC test of 1-phase transformer.
9. Simulate Torque- speed characteristics of induction motor.

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Syllabus of
UNDERGRADUATE DEGREE COURSE

B.Tech. VI Semester

Electrical Engineering

SURESH GYAN VIHAR UNIVERSITY

Effective from session: 2020 – 2021

COMPUTER ARCHITECTURE

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**

2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction to computer organization** Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organisation	6
2	**Memory organization** System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks	6
3	**Input – output Organization** Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.	8
4	**16 and 32 microprocessors** 80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86	8
5	**Pipelining** Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set **Different Architectures** VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming	8
	TOTAL	**36**

POWER SYSTEM –II

Credit: 4 **Max. Marks: 100(IA:40, ESE:60)**
3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Power Flow Analysis** Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.	8
2	**Stability Constraints in synchronous grids** Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.	12
3	**Control of Frequency and Voltage** Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters	8
4	**Monitoring and Control** Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control	12
5	**Power System Economics and Management** Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission andDistributions charges, Ancillary Services. Regulatory framework..	8
	TOTAL	41

POWER SYSTEM PROTECTION

Credit: 3 **Max. Marks: 100(IA:40, ESE:40)**
2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction and Components of a Protection System** Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers.	6
2	**Faults and Over-Current Protection** Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection andovercurrent relay co-ordination.	6
3	**Equipment Protection Schemes** Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar arrangement schemes.	8
4	**Digital Protection** Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.	6
5	**Modeling and Simulation of Protection Schemes** CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing. **System Protection** Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.	10
	TOTAL	**36**

ELECTRICAL ENERGY CONSERVATION And AUDITING

Credit: 4 **Max. Marks: 100(IA:40, ESE:60)**
3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Energy Scenario** Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features. **Basics of Energy and its Various Forms** Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion	12
2	**Energy Management & Audit** Definition, energy audit, need, types of energy audit. Energy management (audit) approachunderstanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.	12
3	**Energy Efficiency in Electrical Systems** Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.	8
4	**Energy Efficiency in Industrial Systems** Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.	8
5	**Energy Efficient Technologies in Electrical Systems** Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.	8

	TOTAL	**48**

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

ELECTRICAL DRIVES

Credit: 4 **Max. Marks: 100(IA:40, ESE:60)**
3L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**DC motor characteristics** Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation	8
2	**Chopper fed DC drive** Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.. **Multi-quadrant DC drive** Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking	12
3	**Closed-loop control of DC Drive** Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design	8
4	**Induction motor characteristics** Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation, vector control of IM, Direct torque control of IM.	8
5	**Scalar control or constant V/f control of induction motor** Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation **Control of slip ring induction motor** Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery	12
	TOTAL	**48**

POWER SYSTEM PLANNING

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**
2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction of power planning:** National and Regional Planning, structure of Power System, planning tools. Electricity Regulation, Electrical Forecasting, forecasting techniques modeling.	6
2	**Power system Reliability**: System Reliability, Reliability Planning Criteria for Generation, Transmission and Distribution, Grid Reliability, Reliability Target, Security Requirement, Disaster Management, Roadmap for Reliability and Quality.	6
3	**Generation Planning**: Objectives & Factors affecting Generation Planning, Generation Sources, Integrated Resource Planning, Generation System Model, Loss of Load (Calculation and Approaches), Outage Rate, Capacity Expansion, Scheduled Outage, Loss of Energy, Evaluation Methods. Interconnected System, Factors affecting interconnection under Emergency Assistance.	8
4	**Transmission & Distribution Planning**: Introduction, Objectives of Transmission Planning, Network Reconfiguration, System and Load Point Indices, Data required for Composite System Reliability. Radial Networks – Introduction, Network Reconfiguration, Evaluation Techniques, Interruption Indices, Effects of Lateral Distribution Protection, Effects of Disconnects, Effects of Protection Failure, Effects of Transferring Loads, Distribution Reliability Indices	8
5	**Demand Side Planning**: Computer aided planning, wheeling. Environmental effects, the greenhouse effect. Technological impacts. Insulation coordination. Reactive compensation.	6
	TOTAL	36

DIGITAL SIGNAL PROCESSING

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**

2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Discrete-time signals and systems** Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate	06
3	**Z-transform** z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using ztransform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.	06
4	**Discrete Fourier Transform** Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Connvolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems	10
5	**Design of Digital filters** Design of FIR Digital filters: Windowmethod, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Bandstop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing	11
6	**Applications of Digital Signal Processing** Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	06
	TOTAL	40

ELECTRICAL AND HYBRID VEHICLES

Credit: 3 **Max. Marks: 100(IA:40, ESE:60)**
2L+1T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	HOURS
1	**Conventional Vehicles:** Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.	6
2	**Hybrid Electric Vehicles** History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.	6
3	**Electric Trains** Electric Drive-trains: Basic concept of electric traction, introduction to various electric drivetrain topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.	6
4	**Energy Storage** Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems	8
5	**Energy Management Strategies** Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).	8
	TOTAL	**36**

POWER SYSTEM - II LAB

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**
0L+0T+2P **End Term Exam: 3 Hours**

1. Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases: (i) LG Fault (ii) LLG Fault (iii) LL Fault and (iv) 3-Phase Fault.

2. Load flow analysis for a given system (for 3 to 6 bus) using (i) Gauss Seidal (ii) Newton Raphson (iii) Fast Decoupled Method and verify results using MATLAB or any available software.

3. Three phase short circuit analysis in a synchronous machine(symmetrical fault analysis)

4. Study of voltage security analysis.

5. Study of overload security analysis and obtain results for the given problem using MATLAB or any software.

6. Study of economic load dispatch problem with different methods.

7. Study of transient stability analysis using MATLAB/ETAP Software.

ELECTRIC DRIVE LAB

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**
0L+0T+2P **End Term Exam: 3 Hours**

1. Study and test the firing circuit of three phase half controlled bridge converter.
2. Power quality analysis of 3 phase half controlled bridge converter with R and RL loads.
3. Power Quality analysis of 3-phase full controlled bridge converter feeding R and RL load.
4. Study and obtain waveforms of 3-phase full controlled bridge converter with R and RL loads.
5. Experimental analysis of 3-phase AC voltage regulator with delta connected, star connected (with floating load), R& RL load
6. Control speed of dc motor using 3-phase half controlled bridge converter. Plot armature voltage versus speed characteristic.
7. Control speed of dc motor using 3-phase full controlled bridge converter. Plot armature voltage versus speed characteristic.
8. Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator.
9. Control speed of a 3-phase BLDC motor.
10. Control speed of a 3-phase PMSM motor using frequency and voltage control
11. Control speed of universal motor using AC voltage regulator.
12. Study 3-phase dual converter.
13. Study speed control of dc motor using 3-phase dual converter.
14. Study three-phase cyclo-converter and speed control of synchronous motor using cyclo-converter.
15. Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter.

POWER SYSTEM PROTECTION LAB

Credit: 1
0L+0T+2P

Max. Marks: 100(IA:60, ESE:40)
End Term Exam: 3 Hours

1. To dESErmine fault type, fault impedance and fault location during single line to ground fault.
2. To dESErmine fault type, fault impedance and fault location during single line-to- line fault.
3. To dESErmine fault type, fault impedance and fault location during double line to ground fault.
4. To study the operation of micro-controller based over current relay in DMT type and IDMT type.
5. To analyse the operation of micro-controller based directional over current relay in DMT type and IDMT type.
6. To study the micro-controller based under voltage relay.
7. To study the micro-controller based over voltage relay.
8. To study the operation of micro-controller based un-biased single-phase differential relay.
9. To study the operation of micro-controller based biased single-phase differential relay.
10. To study the operation of micro-controller un-based biased three phase differential relay.
11. To study the operation of micro-controller based biased three phase

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
MODELLING AND DESIGN OF ELECTRICAL ENGINEERING

MODELLING AND SIMULATION LAB

Credit: 1 **Max. Marks: 100(IA:60, ESE:40)**

0L+0T+2P **End Term Exam: 3 Hours**

1. Simulate Swing Equation in Simulink (MATLAB)
2. Modeling of Synchronous Machine.
3. Modeling of Induction Machine.
4. Modeling of DC Machine.
5. Simulate simple circuits.
6. (a) Modeling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device.
7. (a) Modeling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices.
8. FACTS Controller designs with FACT devices for SMIB system.

Course Title: WIND AND SOLAR ENERGY SYSTEM		Course Code 401	: EE
Semester	: **VII**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 2:1:0**	Credits **Credits**	: **3**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: 36
Continuous Internal Evaluation	: **40 Marks**	SEE **Marks**	: **60**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

Names of common Renewable energy sources.

Course Objectives:

1. Understand the practical application of Renewable energy sources
2. Help the learner to understand basic principle and working of solar system.
3. Understand the application of wind power.
4. Understand the use and application of Solar /PV Cell.

5. Make students familiar with the various types of Renewable energy sources being used in the world today, and different technologies related to them.

GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course. **Physics of Wind Power** History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics- probability distributions, Wind speed and power-cumulative distribution functions.	6
2	**Wind Generator Topologies** Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Con- verter Control.	5
3	**The Solar Resource** Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy avail- ability. **Solar Photovoltaic** Technologies-Amorphous, monocrystalline, polycrystalline; V-I characte- ristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Con- verter Control.	11
4	**Network Integration Issues** Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid distur- bances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind sys- tems.	6
5	**Solar Thermal Power Generation** Technologies, Parabolic trough, central receivers, parabolic dish, Fres- nel, solar pond, elementary analysis.	8
	TOTAL	36

Reference:

1	T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.

2	G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
3	S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
4	H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
5	G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
6	J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991

Course outcomes:

On successful completion of the course, the student will be able to:

1. Analyse and understand the basic and characteristics of Solar/ PV Cell.
2. Apply applications of Renewable energy sources.
3. Apply network theorems practically on Wind Energy.
4. Evaluation of intensity of sun rays and its usability.
5. Work with all types of Renewable energy sources, like Tidal energy, Solar energy, Wind energy, Geothermal energy, Nuclear energy and Biomass energy, in the industry.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Programme Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	S	S	S	S	S	S	S	S	S	S	S	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 8
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	7 to 9
		Graded Assignments		Two Assignments	10	Log of record	1 to 6
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 9
INDIRECT ASS	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course

	End of Course survey		End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Course Title: POWER QUALITY AND FACTS		Course Code 403	: EE
Semester	: **VII**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 2:1:0**	Credits **Credits**	: **3**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: 36
Continuous Internal Evaluation	: **40 Marks**	SEE **Marks**	: **60**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

General Electrical Theorems, Power System Analysis.

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Course Objectives:

1. Explain the basic knowledge representation, problem solving, and learning methods of power planning.
2. Asses the applicability, strength, and weakness of the basic knowledge representation, problem solving and learning methods on power sector.
3. Develop intelligent system by assembling solutions of power system reliability.
4. Develop an interest in the field sufficient to take more advanced subjects.
5. Make students familiar with various types of devices and techniques used in FACTS systems.

SN	CONTENTS	Hours
1	**Transmission Lines and Series/Shunt Reactive Power Compensa- tion** Basics of AC Transmission. Analysis of uncompensated AC transmis- sion lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation	05
2	**Thyristor-basedFlexibleACTransmissionControllers(FACTS)** Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.	05
3	**Thyristor-basedFlexibleACTransmissionControllers(FACTS)** Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.	06
4	**Application of FACTS** Application of FACTS devices for power-flow control and stability im- provement. Simulation example of power swing damping in a single- machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM. **Power Quality Problems in Distribution Systems** Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave- form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve..	10

5	**DSTATCOM** Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Cur- rent Control Techniques in for DSTATCOM. **Dynamic Voltage Restorer and Unified Power Quality Conditioner** Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Con- trol Strategies.	**10**
	TOTAL	**36**

Text/Reference Books	
1	N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technol- ogy of FACTS Systems", Wiley-IEEE Press, 1999.
2	K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.
3	T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.
4	R. C. Dugan, "Electrical Power Systems Quality", McGraw Hill Education, 2012.
5	G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991

Course outcomes:

On successful completion of the course, the student will be able to:

1. Work with various devices used for Power Factor control in FACTS systems, like Static Shunt Compensators, Static Series Compensators, TSSC, TCSC, etc.
2. Use various types of Voltage and Phase Angle Regulators, like TCVR, TCPAR, etc. in industry.
3. Understand the basic operating principles and characteristics of Power Flow Controllers like UPFC and IPFC.

On successful completion of the course, the student will be able to:

1. Represent the dynamics of any simple mechanical, electrical or analogous system as a state-space equation.
2. Derive the transfer function of any simple state-space model using signal flow graph representation or block diagram representation.
3. Solve any state space equations using State Transition Matrix technique.
4. Determine controllability and observability of any system, and make a system controllable using pole placement technique.
5. Represent any discrete system into difference equations, and solve them using z-transform technique.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	2	3	4	5	6	7	8	9	10	11
1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 TO 4
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	1 TO 5
		Graded Assignments		Two Assignments	10	Log of record	1 TO 4
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 TO 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 5, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

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DEPARTMENT OF ELECTRICAL ENGINEERING

Course Title: **CONTROL SYSTEM DESIGN**		Course Code 405	: EE
Semester	: **VII**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 2:1:0**	Credits **Credits**	: **3**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: 36
Continuous Internal Evaluation	: **40 Marks**	SEE **Marks**	: **60**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

Engineering Physics & Circuit Theory.

Course Objectives:

1. Impart knowledge about the concept of Linear vector space and Linear Independence.
2. Learn about differences between Modern and conventional control theory, concept of state, state variable, state vector.
3. Understand state space representation using canonical variables, diagonal matrix. Jordan canonical form, derivation of transfer function from state-space model.
4. Learn Pole placement technique by state feedback, Ackerman's formula.
5. Learn about z-transform, Z-Transfer Function, block diagram analysis of sampled data systems, z and s domain relationship, digital PID controller.
6. Make students familiar with the state-space approach of Control System analysis and various methods to solve the state equations.
7. Introduce the basics of Digital Control Systems to the students.

SN	CONTENTS	Hours
1	**Design Specifications** Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical re- levance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response..	06
2	**Design Specifications** Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical re- levance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.. **Design of Classical Control System in frequency domain** Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.	08

3	**Design of PID controllers** Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control	08
4	**Control System Design in state space** Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the sys- tem, pole placement design through state feedback. Ackerman's For- mula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.	08
5	**Nonlinearities and its effect on system performance** Various types of non-linearities. Effect of various non-linearities on sys- tem performance. Singular points. Phase plot analysis	06
	TOTAL	36

Text/Reference Books	
1	N. Nise, "Control system Engineering", John Wiley, 2000.
2	I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
3	M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
4	K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.
5	B. C. Kuo, "Automatic Control system", Prentice Hall, 1995.
6	J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill, 1995.
7	R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", Saunders College Pub, 1994

Course outcomes:

On successful completion of the course, the student will be able to:

6. Represent the dynamics of any simple mechanical, electrical or analogous system as a state-space equation.
7. Derive the transfer function of any simple state-space model using signal flow graph representation or block diagram representation.
8. Solve any state space equations using State Transition Matrix technique.
9. Determine controllability and observability of any system, and make a system controllable using pole placement technique.
10. Represent any discrete system into difference equations, and solve them using z-transform technique.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	2	3	4	5	6	7	8	9	10	11

1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 TO 4
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	1 TO 5
		Graded Assignments		Two Assignments	10	Log of record	1 TO 4
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 TO 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 5, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

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Course Name : Embedded Systems Lab		Course Code	: EE 431
Semester	: VII	Core / Elective	: CORE
Teaching Scheme in Hrs (L:T:P)	: **0:0:4**	Credits **Credits**	: **2**
Type of course	: **Experiment + File**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE **Marks**	: **40**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

Basics of Computer.

Course Objectives:

1. To understand the Introduction to embedded systems, their characteristics.
2. To understand translation of various features.
3. Discuss functional partitioning for systems.
4. Study of a system design methodology and study of generic synthesis system.

SN	Contents
1	Introduction to Embedded Systems and their working.
2	Data transfer instructions using different addressing modes and block trans- fer.
3	Write a program for Arithmetic operations in binary and BCD-addition, sub- traction, multiplication and division and display.
4	Interfacing D/A converter & Write a program for generation of simple wave- forms such as triangular, ramp, Square etc.
5	Write a program to interfacing IR sensor to realize obstacle dESEctor.
6	Write a program to implement temperature measurement and displaying the same on an LCD display.
7	Write a program for interfacing GAS sensor and perform GAS leakage dESEc- tion.
8	Write a program to design the Traffic Light System and implement the same using suitable hardware.
9	Write a program for interfacing finger print sensor.
10	Write a program for Master Slave Communication between using suitable hardware and using SPI
11	Write a program for variable frequency square wave generation using with suitable hardware.
12	Write a program to implement a PWM based speed controller for 12 V/24V DC Motor incorporating a suitable potentiomESEr to provide the set point.

Reference:

1. Specification and design of embedded systems, David D Gajski, Frandkvahid, S. Narayan, J Garg.

2. Embedded system design, Heath Steve and Newns 1997.
3. Art of programming Embedded Systems, J. Gassle.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Understand the concept of embedded systems, their characteristics.
2. Discuss hardware/software partitioning algorithms.
3. To understand parameters of system design methodology and study of generic synthesis system.
4. Discuss functional partitioning for systems.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	2	3	4	5	6	7	8	9	10	11
1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Practical Performance	Student	1 experiment/ week for 10 experiments	40	Lab Record	1 to 5
		Project		1 Project in the lab	20	Project + Project Report	1 to 5
				Total	**60**		
	ESE	End Sem Evaluation		End of the course	40	Viva + Final performance	1 to 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

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Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

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Course Name : Advanced Control System Lab		Course Code	: EE 433
Semester	: VII	Core / Elective	: CORE
Teaching Scheme in Hrs (L:T:P)	: **0:0:4**	Credits **Credits**	: **2**
Type of course	: **Experiment + File**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE **Marks**	: **40**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

Practical knowledge of Control System Components and their uses.

Course Objectives:

1. Understand the practical application of MATLAB Computing Control Software.
2. Help the learner to understand basic Defining Systems in TF, ZPK form.
3. Understand the application of 2nd order system plot step response and obtain time response specification.
4. Understand the use and application of AC servomotor.
5. Learn how to determine the time-response and frequency-response characteristics of different kind of 2^{nd} order electrical systems using different standard inputs, or by using Bode Plot, and determine its stability.

SN	Contents
1	DESErmination of transfer functions of DC servomotor and AC servomotor.
2	Time domain response of rotary servo and Linear servo (first order and second order) systems using MATLAB/Simulink.
3	Simulate Speed and position control of DC Motor
4	Frequency response of small-motion, linearized model of industrial robot (first and second order) system using MATLAB.
5	Characteristics of PID controllers using MATLAB. Design and implementation of P, PI and PID Controllers for temperature and level control systems;
6	Design and implement closed loop control of DC Motor using MAT-LAB/Simulink and suitable hardware platform.
7	Implementation of digital controller using microcontroller;
8	Design and implementation of controller for practical systems - inverted pen-dulum system.
9	To design and implement control action for maintaining a pendulum in the upright position (even when subjected to external disturbances) through LQR technique in an Arduino Mega.
10	The fourth order, nonlinear and unstable real-time control system (Pendulum & Cart Control System)
11	Mini project on real life motion control system

Reference:

Lab Manual

Course outcomes:

On successful completion of the course, the student will be able to:

1. Analyse and understand the practical application of MATLAB Computing Control Software.

2. Apply applications of Defining Systems in TF, ZPK form
3. Check for the stability of a given closed loop system
4. Plot bode plot for a 2nd order system and find GM and PM
5. Determine time response and frequency response characteristics of a 2nd order system using various techniques described in theory course.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	2	3	4	5	6	7	8	9	10	11
1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Practical Performance	Student	1 experiment/ week for 10 experiments	40	Lab Record	1 to 5
		Project		1 Project in the lab	20	Project + Project Report	1 to 5
				Total	**60**		
	ESE	End Sem Evaluation		End of the course	40	Viva + Final performance	1 to 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)

1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Course Title: **HVDC TRANSMISSION SYSTEM**		Course Code 402	: EE
Semester	: **VIII**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 2:1:0**	Credits **Credits**	: **3**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: 36
Continuous Internal Evaluation	: **40 Marks**	SEE **Marks**	: **60**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

Transmission & Distribution, Power System Analysis

Course Objectives:

1. Analyse the problems of EHV AC transmission
2. Apply and analyse the need of HVDC transmission in solving the problem of long distance transmission.
3. Evaluate the load frequency control mechanism.
4. Apply and evaluate voltage control concept.
5. Create the basic concept of FACTS.
6. Make students familiar with the basic concepts of EHV AC/DC transmission and its parameter control, like Load Frequency control and Voltage Control.

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course. **dc Transmission Technology:** Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVdc Systems. Components of a HVdc system. Line Commutated Converter and Voltage Source Converter based sys- tems.	8
2	**Analysis of Line Commutated and Voltage Source Converters:** Line Commutated Converters (LCCs): Six pulse converter, Analysis neglect- ing commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Ef- fect of Commutation Failure, Misfire and Current Extinction in LCC links. Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.	8

3	**Control of HVdc Converters:** Principles of Link Control in a LCCHVdc system. Control Hierarchy, Firing Angle Controls – Phase Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVdc system: Power flow and dc Voltage Control. Reactive Power Con- trol/AC voltage regulation	**12**
4	**Components of HVdc systems:** Smoothing Reactors, Reactive Power Sources and Filters in LCC HVdc systems DC line: Corona Effects. In- sulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar Operation. Ground Electrodes **Stability Enhancement using HVdc Control:** Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/dc systems.	**12**
5	**MTdc Links:** Multi-Terminal and Multi-Infeed Systems. Series and Pa- rallel MTdc systems using LCCs. MTdc systems using VSCs. Modern Trends in HVdcTechnology. Intro- duction to Modular Multi-level Converters	**8**
	TOTAL	48

Text/Reference Books	
1	K. R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, 2011.
2	J. Arrillaga, "High Voltage Direct Current Transmission", PESEr Peregrinus Ltd., 1983.
3	E. W. Kimbark, "Direct Current Transmission", Vol.1, Wiley-Interscience, 1971.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Solve the problems EHV AC transmission
2. Understand and solve the problems on voltage control.
3. Evaluate the need of HVDC transmission.
4. Prepare for further study in power system.
5. Solve practical problems of power system.
6. Control Load Frequency, Voltage and Power Flow in the EHV AC/DC Transmission systems.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	2	3	4	5	6	7	8	9	10	11
1	S	S	S	S	S	M	M	M	M	M	S

2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S
6	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 5
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	3 to 5
		Graded Assignments		Two Assignments	10	Log of record	1 to 5
				Total	**25**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 5, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	30
2	Applying the knowledge acquired from the course	30
3	Analysis and Evaluation	40

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Course Title: Line-Commutated and Active PWM Rectifiers		Course Code EE 404	:
Semester	: **VIII**	Core / Elective **Core**	:
Teaching Scheme in Hrs (L:T:P)	**: 2:1:0**	Credits **Credits**	: **3**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: 36
Continuous Internal Evaluation	: **40 Marks**	SEE **Marks**	: **60**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

- Power Electronics and Rectifier Concepts
- Electrical Machine and Power Systems

Course Objectives:

1. Analyse controlled rectifier circuits
2. Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
3. Understand the operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode

Line-Commutated and Active PWM Rectifiers

Credit: 3 Max. Marks: 100(CIE:40, ESE:60)

2L+1T+0P End Term Exam: 3 Hours

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course. **Diode rectifiers with passive filtering** Half-wave diode rectifier with RL and RC loads; 1-phase full-wave di- ode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input cur- rent waveshape, effect of source inductance; commutation overlap.	**07**
2	**Thyristor rectifiers with passive filtering** Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave- shape. **Multi-Pulse converter** Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6- pulse converter and 12-pulse converters with in- ductive loads, steady state analysis, commutation overlap, notches during commutation.	**10**

3	**Single-phase ac-dc single-switch boost converter** Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed- loop control structure.	**06**
4	**Ac-dc bidirectional boost converter** Review of 1-phase inverter and 3-phase inverter, power circuits of 1- phase and 3-phase ac-dc boost converter, steady state analysis, oper- ation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.	**07**
5	Isolated single-phase ac-dc flyback converter Dc-dc flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc flyback converter, steady state analysis, unity power factor operation, closed loop con- trol structure.	**06**
	TOTAL	36

Text/Reference Books	
1	G. De, "Principles of Thyristorised Converters", Oxford & IBH Publishing Co, 1988.
2	J.G. Kassakian, M. F. Schlecht and G. C. Verghese, "Principles of Power Elec- tronics", AddisonWesley, 1991.
3	L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
4	N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
5	R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2001.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S
6	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 5
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		Graded Assignments		Two Assignments	10	Log of record	1 to 5
				Total	**25**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 5, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

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Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	30
2	Applying the knowledge acquired from the course	30
3	Analysis and Evaluation	40

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Course Title: **Advanced Electric Drive**		Course Code 406	: EE
Semester	: **VIII**	Core / Elective	: **Core**
Teaching Scheme in Hrs (L:T:P)	**: 2:1:0**	Credits **Credits**	: **3**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: 36
Continuous Internal Evaluation	: **40 Marks**	SEE **Marks**	: **60**
Programmes: **B.Tech Electrical Engineering**			

Credit: 3 Max. Marks: 100(CIE:40, ESE:60)

Pre-requisites:

- EE 204 - Electro-Mechanics
- EE 301 - Power Electronics
- EE 304 - Modern Power Electronics

Course Objectives:

4. Help the learner understand the basic applications, principles and concepts governing Electric Drives and their operation.
5. Learn about the different types of Drives.
6. Obtain a detailed understanding of AC Drives and DC Drives, their applications and their design.
    a. DC Drives – DC Motor s with various converters
    b. AC Drives – Induction Motors/ Synchronous Motors with various converters
7. Understand the Control Methodology for implementing these drives.

SN	CONTENTS	Hours
1	**Power Converters for AC drives:** PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifi- er, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.	12
2	**Induction motor drives:** Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC). **Synchronous motor drives:** Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.	12
3	**Permanent magnet motor drives:** Introduction to various PM mo- tors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM	8
4	**Switched reluctance motor drives:** Evolution of switched reluctance motors, various topologies for SRM drives, comparison. Closed loop speed and torque control of SRM.	8
5	**DSP based motion control:** Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implemen- tation of DSP based motion control	8
	TOTAL	48

Text/Reference Books	
1	B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2	P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.
3	H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Con- trol", CRC press, 2003.

4	R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Understand and implement basic equations governing the operation of drives.
2. Design converters based on the Electric Motor being used in the Drive.
3. Develop a control scheme for the overall control of the Drive.
4. Able to evaluate the performance of a designed drive and its applications.
5. Calculate the evaluating parameters for Electric Drives.
6. The student will have a better understanding of the applications and trends of Electric Drives in the current industry.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	2	3	4	5	6	7	8	9	10	11
1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S
6	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, and self-study cases.

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	CIE	Mid Term Test	Student	Two tests	20	Midterm Answer books	1 to 5
		Weekly Test		Two Weekly Test	10	Weekly Test Copies	1 to 5
		Graded Assignments		Two Assignments	10	Log of record	1 to 5
				Total	**40**		
	ESE	End Sem Evaluation		End of the course	60	Answer scripts at BTE	1 to 5

INDIRECT ASSESSMENT	Student feedback	Students	Middle of the course	-NA-	Feedback forms	1 to 2, delivery of the course
	End of Course survey		End of course		Questionnaire	1 to 5, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

GYAN VIHAR UNIVERSITY
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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Course Name : Energy System Lab		Course Code	: EE 432
Semester	: VIII	Core / Elective	: CORE
Teaching Scheme in Hrs (L:T:P)	: **0:0:4**	Credits **Credits**	: **2**
Type of course	: **Experiment + File**	Total Contact Hours	: **20**
Continuous Internal Evaluation	: **60 Marks**	SEE **Marks**	: **40**
Programmes: **B.Tech Electrical Engineering**			

Pre-requisites:

Practical knowledge of Renewable energy sources

Course Objectives:

1. Understand the practical application of Renewable energy sources.
2. Help the learner to understand basic principle and working of solar system.
3. Understand the application of solar energy.
4. Understand the use and application of Solar / PV Cell.

SN	Contents
1	V-I characteristics of solar panels at various levels of insolation.
2	Experiment of solar Charge controller, PWM, MPPT with boost converter and algorithms.
3	Experiment on Shadowing effect and diode based solution in1kWpSolar PV System.
4	Study of wind turbine generators with DC generators, DFIG, PMSG etc.
5	Performance Study of Solar Flat Plate Thermal Collector Operation with Varia- tion in Mass Flow Rate and Level of Radiation.
6	Characterization of Various PV Modules Using large area Sun Simulator.
7	Study of micro-hydel pumped storage system.
8	Experiment on Fuel Cell and its operation.
9	Study of 100 kW or higher solar PV plant.
10	Study different components of Micro Grid.
11	To design and simulate hybrid wind-solar power generation system using si- mulation software.
12	Experiment on Performance Assessment of Hybrid (Solar-Wind- Battery) Pow- er System.
13	Simulation study on Intelligent Controllers for on-grid and off-grid Hybrid Power Systems.

Reference:

Lab Manual.

Course outcomes:

On successful completion of the course, the student will be able to:

1. Student will be able to analyse and understand the basic and characteristics of Solar/ PV Cell.
2. Apply applications of Renewable energy sources
3. Apply network theorems practically on Solar system.
4. Evaluation of intensity of sun rays and its usability.
5. Work on most of the devices encountered in a Solar Plant, and also will be able to design some of them.

Mapping Course Outcomes with Program Outcomes:

Course outcomes	Program outcomes										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	S	S	S	S	S	M	M	M	M	M	S
2	S	S	S	S	S	M	M	M	M	M	S
3	S	S	S	S	S	M	M	M	M	M	S
4	S	S	S	S	S	M	M	M	M	M	S
5	S	S	S	S	S	M	M	M	M	M	S

S: Strong relationship M: Moderate relationship

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method	**What**		**To whom**	**When/where (Frequency in the course)**	**Max Marks**	**Evidence collected**	**Contributing to course outcomes**
DIRECT ASSMENT	CIE	Practical Performance	Student	1 experiment/ week for 10 experiments	40	Lab Record	1 to 5
		Project		1 Project in the lab	20	Project + Project Report	1 to 5
				Total	**60**		
	ESE	End Sem Evaluation		End of the course	40	Viva + Final performance	1 to 5
INDIRECT ASSESSMENT	Student feedback		Students	Middle of the course	-NA-	Feedback forms	1 to 4, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 9, Effectiveness of delivery of instructions and assessment methods

CIE – Continuous Internal Evaluation **ESE** –End Semester Examination

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GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	25
3	Analysis and Evaluation	40

Department: Electrical Engineering

Masters in Technology (Power Systems)	
Programme Outcome	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. **Life-long learning**: 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. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
Programme Specific Outcome	Able to apply the knowledge gained during the course of the program from Mathematics, Basic Computing, Basic Sciences and Social Sciences in general and all electrical courses in particular to identify, formulate and solve real life problems faced in industries and/or during research work.
	Able to provide socially acceptable technical solutions to complex electrical engineering problems with the application of modern and appropriate techniques for sustainable development.

	Able to apply the knowledge of ethical and management principles required to work in a team as well as to lead a team.	
Course Code	**Course Name**	**Course Outcomes**
EE 501	Advanced Power System Analysis	Understand and analyse the behaviour of the power systems under different fault conditions. Understand and analyse the behaviour of induction machines under unbalanced operations Understand the mathematical model for synchronous machines. Understand the concept of linear graph theory and its use to solve electrical problems. Solve and analyse the load flow problems Calculate fault parameters in any 3-phase Induction machine or Synchronous machine in a Power System.
EE 502	Advanced Power System Stability	Student will be able to model various synchronous machines. Solve swing equation and understand various stability, Able to develop SMIB system & solve coherent non coherent system, Give solution to various stability problems eg fault clearing time, critical clearing angle etc.
EE 504	HVDC Transmission	Measure and calculate the switching behaviour of thyristor and IGBT valves Design power electronic converters (AC- DC, DC - DC) Understand control schemes for HVDC systems and their control Measure and remove harmonics. Understand the application of MTDC systems. Work on and design the widespread HVDC Power Systems in the industry.
EE 505	Advanced Power Electronics	Student will be able to understand the application of phase controlled converter , Understand the different type of chopper and their application, Understand the 1 phase and 3 phase inverters and their applications and harmonic reduction techniques, Understand AC voltage controller
EE 506	Power System Transients and Protection	Understand the transient wave phenomenon in power systems Understand the impact of grounding on the behaviour of power systems Understand the working of static relays in power systems Understand the working of comparators in static relays and to use them in various protective schemes. Understand the operation of switchgear in power systems. To be able to understand the above related field problems. Calculate the values of Power System Transients in any basic scenario, and suggest the appropriate protective relay or circuit breaker for that case.
EE 508	Advanced Power System	Student will be able to analyse voltage stability Understand distribution automation and SCADA Able to apply FACTS devices Able to audit electrical utilities. Understand superconductivity and applications Understand the methods to charge for the transmission line uses and for the power losses in transmission system. Work on the relatively newer components of Power Systems in industry, like SCADA, FACTS and Superconductors.
EE 512	Smart Grid: Design & Applications	.Acquire in-depth understanding on recent development of power grids, i.e. smart grid; Apply advanced analysis tools in planning and operation of smart grids, Acquire skills in presentation and interpretation of results.
EE 553	Power System Design using PSCAD	Apply the theory covered in courses to obtain working simulations of advanced Electrical Engineering circuits. Will be able to use PSCAD for designing of circuits/systems that have been covered in their theoretical topic thus far. Through the project development, students will be able to showcase their skills in modelling an Electrical Engineering/Power System through PSCAD. Understand the process of implementing design in the simulation. Simulate any Power System component or scenario in the industry.
EE 601	Power System Planning and Reliability	Perform reliability analysis on electrical systems. Evaluate possible sources of unreliability in the system and its possible causes. Perform analysis using the Reliability concept for systems under study.

		Plan an electrical system with proper reliability analysis while taking into consideration the future loads. Evaluate Reliability of different components of Power System in industry, like Static Generating Capacity, Spinning Generating Capacity and Transmission Capacity.
EE 603	Operation and Control of Power System	Student will be able to analyze various constraints of optimal power system operation Solve the unit commitment problem Solve the optimal generation scheduling Understand the speed governing system of steam turbine and analyse steady state and dynamic response. Understand power system security and AGC Suggest and implement methods for various aspects of Optimal Power System operation in the Power System industry.
EE 609	Restructured Power Systems	Understand the need of restructuring of the power industry and the behaviour of affected parties. Understand how the electricity is different from other commodities and how the mathematical tools be used to manage the congestion of the transmission lines using PTDF and LODF. Understand the basics of the methods to determine the electricity price at different nodes. Understand the concept of ancillary services in restructured power systems which are required to run the power system in a smooth manner.
EE 611	Solar Radiation & Energy Conversion	To familiarize students with the characteristics of solar radiation, its global distribution, and conversion methods of solar energy to heat and power