Semester: 1

Course code: HU 1101
Course title: Technical English

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week
Course Objectives: This course enables the students:

1. To Develop communication skills with LSRW skills which is a must in competitive world.
2. To emphasize the importance of language in academic and employability
3. To empower the communicative skills, to enhances the employability skills with self-confidence.
4. To make inferences and predictions based on comprehension of a text
5. To transform into a dynamic personality with confidence.

Syllabus

Module I:
Single word substitution, idioms and phrases, pairs of words, common errors, précis, comprehension, expansion.
Module II:
Official correspondence- Memorandum, Notice, agenda, minutes, circular letter, applying for a job, resume, demo official letter.
Module III:
Business correspondence: Types, sales letters, social correspondence- invitation to speak, congratulations etc.
Module IV:
Report writing; general and technical report, Definition, Types, structure
Module V:
Technical proposals, Definitions, types and format.
Module VI:
Research papers and articles
Module VII:
Mechanics of manuscript preparation

Course Outcomes:
On completion of this course, the students will be able to:

1. Develop their LSRW skills.
2. Overcome their Mother tongue influence.
3. Express/interpret their views without hesitation.
4. Lose their stage fear and develop self-confidence.
5. Able to reach corporate expectations.

Text Books:

1. Raul, Asha, Effective Business Communication, Prentice Hall of India.
2. Berry, Thomas Elliot, The most Common Mistakes in English Usage; Tata McGraw Hill.
3. Report Writing and Business Correspondence Mohan and Sharma, Tata McGraw Hill Publications, India

Reference Books:

1. Blickle, Margaret D., and K.W.Houp. Reports for Science and Industry, Henry Holt & Co. N.Y.
2. Duddy, E.A. & M.J. Freeman Written Communication in Business, Amercian book Co. N.Y.
3. Berry, Thomas Elliot, The most Common Mistakes in English Usage; Tata McGraw Hill.

Course code: PH1201
Course title: Physics

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): Knowledge of basic physics and mathematics

Class schedule per week: 4 classes per week

Course Objectives: This course enables the students:

1. Knowledge/discussion about Newtonian Mechanics and Relativistic mechanics with emphasis to the special theory of relativity.
2. Discussion about the basic principles and phenomenon on physical optics and its application in advanced technology.
3. Discussion about the basic electromagnetic theory and its application in today's communication, electrical and electronic industry.
4. Discussion about the quantum mechanical principle and its application towards miniaturization.
5. Illustrate working of Lasers and optical fibers. Basic nuclear and plasma physics are discussed

Syllabus:

MODULE – I

Special Theory of Relativity: Introduction, Inertial frame of reference, Galilean transformations (Ch1- Appendix), Postulates (AB 1.1), Lorentz transformations and its conclusions (AB ch1- Appendix), Length contraction, time dilation, velocity addition (AB 1.2, 1.4, Ch1 Appendix), Mass change (AB 1.7), Einstein's mass energy relation. (AB 1.8).

MODULE – II

Physical Optics: Polarization, Malus' Law, Brewster's Law, Double Refraction [AG 22.1 – 22.3], Interference in thin films (Parallel films) [AG 15.1 - 15.2], Interference in wedge-shaped layers [AG 15.8], Antireflection coating (qualitative) [AG 15.4], Newton's rings [AG 15.10], Fraunhofer diffraction by single slit [AG 18.2], Double slit and grating (qualitative) [AG 18.6 - 18.7], Resolving Power, Limit of Resolution, Rayleigh Criterion [AG 18.5]

MODULE – III

Electromagnetic Theory I: Gauss's law (SAD 4.5), Applications (SAD 4.6), Concept of electric potential (SAD 4.7), Relationship between E and V (SAD 4.8), Polarization of dielectrics (SAD 5.5), dielectric constant (SAD 5.6), Boundary conditions for E & D (SAD 5.9), Gauss's law in magnetostatics, (SAD 7.5), Ampere's circuital law (SAD 7.3), Boundary conditions for B & H (SAD 8.7)

MODULE – IV

Electromagnetic Theory II: Equation of continuity of charge (SAD 5.8), Displacement current (SAD 9.4), Maxwell's equations, (SAD 9.5), Electromagnetic plane wave equations for free space and dielectrics (SAD 10.3 to 10.6), Poynting vector (SAD 10.7), Fresnel's equation (qualitative) (SAD 10.8, 10.9)

MODULE – V

Quantum Mechanics: Planck's theory of black-body radiation (AB: 2.2 & 9.6), Compton effect (AB: 2.7), Wave particle duality, De Broglie waves (AB: 3.1), Davisson and Germer's experiment (AB: 3.5), Uncertainty principle(AB:3.7,3.8,3.9), physical interpretation of wave function (AB:3.2), Schrodinger equation in one dimension (AB:5.2), free particle(AB:3.6, 5.5, 5.6), particle in an infinite square well(AB: 5.8), potential barrier and tunneling (qualitative) (AB:5.10)

MODULE – VI

LASERS: Spontaneous and stimulated emission (AB: 4.9, and AG: 23.1), Einstein's A and B coefficients, Population-inversion (AG: 23.4), Light amplification, Basic laser action, Ruby and He-Ne lasers, Properties and applications of laser radiation (AG: 18.1), Elementary ideas of fiber optics (AG: 24.1-24.3).

MODULE – VII

Nuclear Physics: Nuclear forces, binding energy, liquid drop model, fission, nuclear reactors, fusion. [2] Plasma Physics: Plasma state, types of plasma, applications of plasma (FFC-Ch-1,2).

Course Outcomes: After completion of the course, the learners will be able to:

1. Understand the inertial and non-inertial frame of reference in relativistic mechanics. Understand the transformation of physical observation from one frame of reference to other frame of reference.
2. Understand the different phenomenon of light (electromagnetic wave) and understand applications of optics using basic fundamentals of Physics.
3. Understand Concept of gradient, operator, divergence and curl; Line, surface and volume integrals. Understand magnetic fields and forces. Understand the electric field in dielectric and the basic equations of electromagnetism.
4. Understand the basic of quantum mechanics and its importance for an engineer with some applications.
5. Understand and explain nuclear reactions, controlled chain reactions and plasma physics.

Text Books:

1. Arthur Beiser (AB), Concept of Modern Physics, 6th edition 2009, Tata McGraw- Hill.
2. A. Ghatak (AG), Optics, 4th Edition, Tata Mcgraw Hill, 2009
3. Mathew N.O. Sadiku(SAD), Elements of Electromagnetics, Oxford University Press (2001)
4. F.F.Chen (FFC), Introduction to Plasma Physics, 2nd Edition, Plenum Press, 1994.

Reference Books:

1. Halliday, Resnick, Walker , Fundamentals of Physics, John Wiley & Sons 2004
2. H. K. Malik, A. K. Singh, Tata Mcgraw Hill, 2010.

Course code: CH1401
Course title: Engineering Chemistry

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): High school level chemistry

Class schedule per week: 3 classes per week

Course Objectives: This course enables the students:

1. To develop the basic understanding about materials and its physical & chemical properties.
2. To develop the link between fundamental knowledge with industrial process, manufacturing and technology.
3. To develop analytical skills towards quality, purity in chemical processes,
4. To encourage for higher studies, research, innovation and self-entrepreneurship.

Syllabus:

Module I

Phase Rule: Terms Involved, Phase diagram of one component (Water) & two component (Pb/Ag) system & their applications.

Module II

Fuel & combustion: Classification, Properties, calorific value determination (theoretical & experimental), flue gas analysis & combustion calculation.

Solid fuel: Classification of coal, Proximate & Ultimate Analysis, Carbonization and pyrolysis, recovery and purification of by –products obtained from coke ovens.

Module III

Liquid fuels: Composition of crude oil, processing of crude oil, synthetic oil Diesel : Diesel engine ignition temperature, Flash point, Fire point, Smoke point, Cetane no Petrol : Spark ignition IC engine, Gasoline fuel, Grading gasoline Knocking, Additives & Dopants, Octane no., Alternative fuels (Propane, Methanol, Ethanol)

Gaseous fuels: Water Gas, Producer gas, Coal gas

Lubricants: Classification – Liquid, Semi solid & Solid Lubricants; Properties of lubricants: Viscosity & Viscosity Index, Cloud Point & Pour Point, Aniline Point, Dropping Point, Saponification, Carbon Residue, Oiliness, Mechanism of Lubrication, synthetic lubricants, Grease.

Module IV

Kinetics: Introduction: Order and Molecularity of reaction, Factors affecting reaction rates, Activation Energies, Theories of reaction rates – Collision theory and transition state theory, Rate Laws – 0^{th} order, 1^{st} order and 2^{nd} order reaction, Reactions: Chain, Parallel/Competing/Side, Consecutive; Study of Fast reactions-Flash Photolysis.

Module V

Catalysis: Introduction and characteristics of catalyst, types of catalysis (homogenous, heterogeneous and auto catalysis with example), catalytic poison; Theories of catalysis, intermediate compound formation and adsorption or contact theory with examples, advantage and disadvantages; Acid base catalysis- including kinetics and examples, Enzyme catalysis- Mechanism and kinetics of enzyme catalyzed reaction, Michaelis-Menten equation, Important catalysts in industrial processes (a) Bosch Process (b) Habers process (c) Contact process (d) Ostowald process (e) Bergius Process, Hydrogenation using Wilkinsons catalyst, Hydroformylation by using Cobalt-catalyst.

Module VI

Polymers: Introduction to polymers; Polymer characterization; Mechanism of polymerization (Free radical, Anionic & Cationic); Molecular Weight of polymers; Glass Transition Temperature, structure property relationship (chemical, electrical, optical and mechanical); A brief introduction to inorganic polymers.

Module VII

Corrosion Chemistry: Chemical and Electrochemical corrosion, Factors affecting the rate of corrosion, Types of corrosion, Protection & Inhibition, Paints & Coatings: Constituents, Binders, Driers, Pigments, Thinners, Fire retardant paints, Antifouling paints.

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

1. Explain Qualitative and quantitative effects of temperature and pressure on homogeneous and heterogeneous systems (Eutectic and Alloys e.g., soldering and safety fuses)
2. Analyze and compare different conventional fuels (solid, liquid and gas) both qualitatively and quantitatively. Formulate cost effective blended liquid fuel and lubricant
3. Understand the reaction dynamics of different physical and chemical reactions. Understand the underlying catalytic mechanism in different industrial and biological processes
4. Understand the structure property (electrical, mechanical) relationship of polymer which enables the student to develop new polymeric materials
5. To control and prevent the degradation of the metallic components of instruments and machines.

Text books:

1. Physical Chemistry 7th Edition: P. C. Rakshit
2. Engineering Chemistry: Jain & Jain
3. Applied Chemistry: A Text book for engineers and technologists by H.D.Geyser, Plenum publishers

Reference books:

1. Physical Chemistry: P.W. Atkins
2. Textbook of Physical Chemistry: S. Glasstone

Course code: MA1201
Course title: Engineering Mathematics

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): Basics of algebra, calculus, trigonometry, coordinate geometry

Class schedule per week: 4 classes per week

Course Objectives: This course enables the students to:

1. gain knowledge about the convergence and divergence of infinite sequences and series
2. understand the functions of two or more variables, their differentiation, properties and applications
3. study multiple integrals and their applications in solving area, volume, centre of mass, moment of inertia etc.
4. develop polar equations of conics and their properties.
5. study vector functions, their properties and concepts of gradient, divergence and curl.
6. Integration of vector functions and various theorems related to them.

Syllabus:

Module I

Sequences, bounded sequences, upper and lower bounds, monotonic sequences, limits of a sequence, convergence of sequence, Cauchy's general principle of convergence, Cauchy's theorems on limits (No proof).

Module II

Convergence of series of real numbers of positive terms, p - series test, comparison tests, Cauchy's root test, D' Alembert's ratio test, Raabe's test. Gauss's Ratio Test, Logarithmic and Higher logarithmic ratio Test, Absolute and conditional convergence, Leibnitz's Rule for alternating series Test.

Module III

Generalized Mean Value Theorem, Maclaurin's series, Taylor's series of functions.Functions of several variables, level curves, limits, continuity, partial Derivatives. Euler's theorem on Homogeneous functions, chain Rule, transformation of independent variables, total differential. Jacobians, Taylor's series in two or more variables. Maximum, minimum and saddle points of functions of two variables. Several independent variables Lagrange's method of Undetermined Multipliers.

Module IV

Beta and Gamma functions, Double integrals, area, change of order of integration, evaluation of integrals by transforming into polar co-ordinates, evaluation of Triple integrals. Volume and surface area by double and triple integration by transforming in to cylindrical and spherical polar co-ordinates.

Module V

Sketching polar equations of conic section, equation of tangent and normal line to a conic section equation of tangent and normal line to a conic section including chord of contact, director circle and asymptote.

Module VI

First order differential equations, linear and Bernoulli's equation, Reduction of order. Curvature, normal vector, torsion and TNB frame, tangential and normal components of velocity and acceleration, radial and transverse acceleration. Motion in polar and cylindrical coordinates. Directional derivative, Gradient, Divergence and curl. Expansions, identities. Tangent plane and normal line Gradient, divergence and curl in curvilinear coordinates.

Module VII

Line integrals, Work, Circulation, Flux, Path independence, Potential function, Conservative field, Green's theorem in plane, surface and volume integrals Gauss's Divergence theorem, Stoke's theorem. Applications

Course Outcome: After completion of the course, the students will be able to:

1. represent voltage and current in terms of series for steady state analysis.
2. deal with problems related to computational geometry, image processing, biotechnology etc. using series representation.
3. get an understanding of partial derivatives and their applications in finding maxima - minima problems.
4. apply the principles of integrals to solve a variety of practical problems in engineering and sciences.
5. gain an understanding of polar equations of conics, their tangent, normal, chord of contact etc. especially in orbital systems.
6. solve engineering problems of fluid mechanics, electrostatics, thermodynamics etc. involving derivatives (gradient, divergence, curl etc.) and integrals (surface, volume etc.) of vector functions.
7. enhance and develop the ability of using the language of mathematics in engineering.

Text Books:

1. M.D. Weir, J. Hass and F. R. Giordano: Thomas' Calculus, 11th edition, Pearson Educations, 2008.
2. Dennis G. Zill and Warren S. Wright: Advanced Engineering Mathematics, 4th edition, Jones Nad Bartlertt Publishers, 2010

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, 8th Edition John Wiley and sons 1999.
2. T.M. Apostol: Calculus Vols 1 and 11.2nd Edition. John Wiley and sons, 1967 and 1969.

Course code: AM 1201
Course title: Engineering Mechanics

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Class schedule per week: 4 classes per week
Course Objectives: Objectives of this basic subject of engineering are:

1. to explain the importance of mechanics in the context of engineering
2. to build a strong foundation for analyzing engineering problems
3. to introduce students with as many general methods of attack in solving mechanics problems as possible
4. to illustrate the application of these methods to practical engineering problems related to mechanics
5. to avoid routine drill in the manipulation of standardized method of solution
6. when to idealize the object as particle or rigid body
7. to make the students realize the importance of free-body diagrams and the process of drawing it
8. to identify the types of force fields and force systems and finding the resultant of different force systems.

Syllabus:

Module 1: Equivalent Force System & Equilibrium

a) Review of vectors, vector representation of forces and moments.
b) Principle of statics, laws of mechanics, free body diagram, conditions of equilibrium, Co-planar, Non coplanar and spatial force system, Equivalent forces and moment, Wrench

Module 2: Structural Mechanics

a) Analysis of plane trusses by method of joints and by method of sections, Analysis of plane frames with hinged joints.
b) Analysis of parabolic suspension cables
c) Relation between load, shear force and bending moment, shear force and bending moment of cantilever and simply supported beam with concentrated, uniformly distributed & triangular distributed loads and moments.

Module 3: Interfacial Friction

a) Laws of dry friction, static & kinetic co-efficient of friction, Analysis of static, kinetic and rolling friction.
b) Analysis of frictional forces in inclined planes, wedges, screw jacks and belt drives.

Module 4: Moment of Inertia

a) Calculation of area moment of inertia of different geometric sections, parallel and perpendicular axis theorem, Moment of inertia of composite sections, Principal axis and principal moments of inertia.
b) Calculation of mass moments of inertia of thin plates, thin rectangular plate, thin circular disc, Mass moment of inertia of Solids-rods, cylinder, prism, sphere, cone.

Module 5: Kinematics & Kinetics of Particles

a) Rectilinear motion of particle, Determination of motion of a particle – displacement, velocity, acceleration, Relative motion
b) Curvilinear motion of particle, Rectangular components, Projectile motion, projection on inclined plane, escape velocity, uniform circular motion, tangential and normal acceleration
c) Equation of motion, D'Alembert's principle, Analysis of lifting (pulley) motion, motion of several connected bodies, linear momentum, angular momentum

Module 6: Kinematics & Kinetics of Rigid Bodies

a) Types of rigid body motion – translation, rotation about fixed axis, equations defining the rotation of a rigid body about a fixed axis, plane motion, absolute and relative velocity in plane motion, instantaneous center of rotation.
b) Equation of translational and rotational motion, Newton's law and D'Alembert's principle – inertia force and inertia couple, center of percussion, constrained motion – non centroidal motion.

Module 7: Work Energy & Impulse Momentum

a) Translation and rotation of rigid body about a fixed axis, conservation of energy, Energy and work equations in translation & rotational motion virtual work.
b) Impulse force and momentum, conservation of momentum, coefficient of restitution, moment of momentum equation.

Course Outcomes:

At the end of the course, a student will be able to –

1. apply the principle and how to apply them
2. develop mathematical model of the system of particles or rigid body for analysis
3. find key parameters needed to design a system of components
4. have clarity of ideas about how to solve engineering problems related to mechanics, and different ways of solving similar types of problems

Text Book:

1. Engineering Mechanics - Statics & Dynamics by S. Rajasekaran and G. Sankara Subramanian, (Vikas Publishing House Pvt. Ltd, New Delhi, 1999)

Reference Books:

1. Engineering Mechanics (3^{rd} edition) by Dr. K.L. Kumar, (Tata McGraw Hill Pub. Co. Ltd, New Delhi, 1998)
2. Engineering. Mechanics by Irving H. Shames, P H I. ltd.
3. Vector Mechanics, Statics and dynamics (S.T) By Fordinand P.Beer & E.Russall Johnson, Tata MeGraw Hill Pub. Co. Ltd.

SESSIONAL / LABORATORY:

Course code: ME1202
Course title: Engineering Graphics

Credits:	**L**	**T**	**P**	**C**
	1	0	3	3

Course Objectives:

1. To understand the basic principles of engineering drawing
2. To visualize an object & convert it into a drawing
3. To gain knowledge of conventional representation of various machining details
4. To draw & interpret various projections of 1D, 2D & 3D objects
5. To visualize different views of any objects
6. To fulfil the requirement of knowledge, imagination & drawing skill
7. To inculcate the imagination & mental visualization capabilities for interpreting the geometrical details of common engineering objects

Syllabus:

Sheet No. 1A: Lines and Lettering

Sheet No. 1B: Projection of points

Sheet No. 2: Projections of Straight Lines.

Sheet No. 3: Projections of Planes.

Sheet No. 4: Projections of Solids.

Sheet No. 5: Section of solids.

Sheet No. 6: Isometric Projections.

Sheet No. 7: Development of Surfaces.

Sheet No. 8: Intersection of surfaces.

Course Outcomes:

At the end of the course, a student will be able to –

1. Draw orthographic projections of lines, planes and solids
2. Convert isometric scale, isometric projections & views
3. Draw sections of solids including cylinders, cones ,prisms & pyramids
4. Visualize & prepare details drawing of a given object
5. Draw assembly of mechanical systems
6. Read and interpret a given drawing
7. Sketch simple machine parts in isometric projections
8. Use engineering drawing in their respective engineering field
9. Understand boundary layer formation over heated surfaces during forced and free convection, formulation of momentum and energy equations of the laminar boundary layers and their solution by approximate method.

Referred Books:

1. Engineering Drawing – Dhananjoy A. Jolhe.
2. Engineering Graphics – N.D. Bhat.

Course Code: CS1302

Course Title: Fundamentals of Unix & C Programming

Credits:	**L**	**T**	**P**	**C**
	1	0	3	3

Pre-requisites: Familiarity with high school algebra is expected, however the course assumes no prior programming language.

Course Objectives:

This course enables the students:

1. To understand the UNIX environment and its various commands
2. To understand the various steps in Program development.
3. To understand the basic concepts in C Programming Language.
4. To learn how to write modular and readable C Programs.
5. To learn to write programs (using structured programming approach) in C to solve problems.

Syllabus:

List of the Experiments:

1. Write an interactive program that will read in a +ve integer value and determine the following
   i) If the integer is a prime number ii) If the integer is a Fibonacci number
2. WAP in C to compute sinx = $x - x^3/3! + x^5/3! - x^7/7!$ ….. Continue adding successive terms in the series until the value of the next term becomes smaller (in magnitude) than 10^{-5}. Test the program for x = 1, x = 2, and x = 3. In each case display the number of terms used to obtain the final answer.
3. WAP to generate every 3rd integer beginning with I = 2 and continue for all integers that are less than 150. Calculate the sum of those integers that are evenly divisible by 5.
4. WAP to find whether a given year is a leap year or not. Modify it to generate a list of leap years between two year limits given by user.
5. WAP to display the following pattern :

```
                    11
              11    10    11
        11    10    9     10    11
  11    10    9     8     9     10    11
```

6. Using Ternary / Conditional operator find the greatest among 3 numbers.
7. WAP to convert a decimal number into an equivalent number of the input base. Test your program for base 2,8,10 & 16.
8. WAP to read a number n, and print it out digit-by-digit, as a series of words. For e.g. 123 would be printed as “one two three”.
9. WAP to check whether any input +ve integer is palindrome or not.
10. WAP to simulate a simple calculator (+ - / * %) that takes two operands and an operator as input and displays the result.
11. WAP to find the GCD of two input +ve integer numbers.
12. WAP to swap the values of two variables without using a third variable.
13. Read a line of mixed text, and then write it out with all lower case and uppercase letters reversed, all digits replaced by 0s and all other characters (non-letters and non-digits) replaced by ‘*’.
14. WAP to find the product of two matrices A and B. Display the source matrices and product matrix C in matrix format.
15. WAP to find whether a given matrix is a triangular matrix or not.
16. WAP to find the transpose of a matrix. Display the source and the transposed matrix in matrix format.
17. Implement Prob. No. – 14 to 16 using functions for reading, manipulating and displaying the corresponding matrices in matrix form.
18. WAP to sort a list of strings alphabetically using a 2-dim. Character array.
19. WAP to display the row sum and the column – sum of an input 2- dim. Matrix. Display the source matrix with row and column sum.
20. Write a recursive function to calculate S = 2 + 4 + 6 + 8 + …… +2N. Implement the function in a complete C program.

21. Write a function that accepts two arguments an array and its size n. It performs Bubble up sort on the array elements. Using indirection operator '*' implement this in a complete C program. Display the source and the sorted array.
22. Using pointer, write a function that receives a character string and a character as argument. Delete all occurrences of this character in the string. The function should return corrected string with no holes.
23. Write a function for reading character string using pointer. Calculate the length of the string (without using strlen ()). Finally print the string in reverse order, using pointer.
24. Implement prob. No. 14 using pointers representation of 2 – dimensional array.
25. Implement prob. No. 15 using pointer representation of 2 dimensional array.
26. Implement prob. No. 16 using pointer representation of 2 dimensional array.
27. WAP to sort a list of strings into alphabetical order using array of pointers.
28. Create records of 60 students, where each record has fields-name, roll, gpa and fees. Write a function update () to reduce the fees of those students who have obtained gpa greater than 8.5 by 25% of the original fees. Write a complete program to exercise this function in the main program and display all the records before and after updation.
29. Define a structure that describes a hotel. It should have members that include the name, address, grade, average room charge and number of rooms. Write a function to perform the following operations:
    a) To print out hotels of a given grade in order of charges.
    b) To print out hotels with room charges less than a given value.
30. WAP to concatenate the contents of two files into a third file.
31. WAP to copy the content of one file into another file. Names of both the files are to be input as command line arguments.
32. The call sort +r to the program sort.c should sort an input list of element in ascending order and display the list before sorting & after sorting.
33. Perfrom operations with the following unix commands.
    (a) mkdir (b) cd .. (c) pwd (d) ls (e) who (f)tty (g) vi (h) cp (i) mv (j) rm (k) rmdir
34. Perform operations with the following vi editior commands in unix.
    J, k, l, :wq!, :q!, nx , ndw, ndd , nyy & p, :se nu, i, a, Esc.

Course Outcomes:

Upon completion of this course, the student will be able to:

1. log into UNIX operating system, create their own directories and files, move around among different files and directories, create, files in different ways.
2. create, edit, debug and execute C programs using the Vi-editor.
3. to apply solving and logical skills to programming in C language

Referred Books:

1. Kernighan K. R., Ritchie D. M. - The C Programming Language, Ansi C Edition, Prentice Hall, India.
2. E. Balagurusamy – Programming in ANSI C, 3rd Edn. , TMH, New Delhi ; 2004.
3. A. N. Kanthane – Programming with ANSI and TURBO C, Pearson Education, New Delhi; 2004.
4. Y. Kanetkar – Let us C, 4th Edition, BPB Publication , New Delhi; 2002.
5. Chris DiBona, Sam Ockman , Open Sources : Voices from the Open Source Revolution (Web book), Oreilly Press, 2nd edition,1999.

Course code: PH1202
Course title: Physics Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Knowledge of fundamental concepts of physics
Class schedule per week: 3 classes per week
Course Objectives: This course enables the students:

1. To expose them to experimental demonstrations of theoretical concepts of engineering physics
2. To develop basic experimental skills in basic electrical and optics based physical problems.
3. To develop understanding about errors in measurements, limits of accuracy, use of significant digits
4. To professionally document the findings and communicate the significance of engineering physics experiments.

Syllabus:
List of Experiments:

1. To determine the frequency of AC mains with the help of sonometer
2. To determine the wavelength of sodium light by Newton's rings method
3. To determine the resistance per unit length of a Carey Foster's bridge wire and then to find the resistivity of the material of a given wire
4. Measurement of mechanical equivalent of heat by electrical method
5. Determination of refractive index of the material of a prism using spectrometer and sodium light
6. To determine the frequency of electrically maintained tuning fork by Melde's experiment
7. Measurement of voltage and frequency of a given signal using cathode ray oscilloscope
8. To determine the wavelength of prominent spectral lines of mercury light by a plane transmission grating using normal incidence
9. To determine the electromotive force (emf) of an unknown cell using a stretched wire potentiometer
10. To study the frequency response and quality factor of series LCR circuit.
11. To find the specific rotation of sugar solution by using a polarimeter.
12. To determine the Hall voltage and calculate the Hall coefficient and carrier concentration of a semiconductor sample

Course Outcomes: After completion of the course, the learners will be able to:

1. understand and analyze the sources of error in measurements and attempt to reduce them.
2. use basic electrical and optical instruments.
3. prepare a good laboratory report.
4. demonstrate basic electrical and optical experiments.

Text Books:

1. Physics Laboratory Manual for First Year BE programme – Department of Physics, BIT, Mesra, (Revised on 2016).

Course code: PE 1202
Course title: Workshop Practice

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Knowledge in dimensions and units, Usage of geometrical instruments, Analytical ability
Class schedule per week: 3 classes per week

Course Objectives: This course enables the students to

1. To impart knowledge and skill to use tools, machines, equipment, and measuring instruments.
2. ability to select manufacturing process and machine tool for the part drawing given.
3. To develop a skill in dignity of labour.
4. team working and development of right attitude. Educate students of safety and Safe handling of machines and tools.

Syllabus:
List of Experiments:

1. **MACHINE SHOP:**

   EXPERIMENT-I CENTER LATHE
   Objective: To study lathe machine and machine a given job as per given drawing.
   EXPERIMENT-II SHAPER MACHINE
   Objective: To study lathe machine and machine a given job as per given drawing.

2. **CARPENTRY SHOP:**

   EXPERIMENT-I CARPENTRY TOOLS AND INSTRUMENTS
   Objective: To study the various tools, instruments and equipment used in carpentry practice.
   Experiment-II carpentry practice
   Objective: To learn the carpentry work by making a wooden job using different tools.

3. **FITTING SHOP:**

   EXPERIMENT-I FITTING TOOLS AND MEASURING INSTRUMENTS
   Objective: To study the various tools uses and operation performed in fitting (like marking, chipping, hack-sawing, filing, drilling etc.)
   EXPERIMENT-II FITTING ASSEMBLY PRACTICE
   Objective: To make a job clamping plate as per given drawing by fitting and check for its assembly with a given component.

4. **FORGING SHOP:**

   EXPERIMENT-I FORGING TOOLS AND FORGING PRACTICE
   Objective: To study different tools and equipments used in hand forging practice.
   EXPERIMENT-II To learn about hand forging practice by making a job (make a square bar from round blank and bend it at a sharp corner of 90 degree as per drawing).
   Objective: To study lathe machine and machine a given job as per given drawing.

5. **FOUNDRY SHOP:**

   EXPERIMENT-I GREEN SAND MOULDING
   Objective: To get acquainted with various tools and equipment used in making green sand mould (to practice green sand mould making with single piece pattern).
   EXPERIMENT-II ALUMINIUM CASTING
   Objective: To get acquainted with melting and pouring of metal in a mould (given two piece patterns of handle and make aluminium casting.

6. **WELDING SHOP:**

EXPERIMENT-I MANUAL METAL ARC WELDING
Objective: To learn about arc welding practice different arc welding machine (AC & DC), electrode and equipments.
EXPERIMENT-II GAS WELDING
Objective: To study gas welding processes different type of flames produced filler metal and flux etc. To joint two pieces of given metal by gas welding process.

Course Outcomes: After completion of the course, the learners will be able to:

1. Understand the Basics of Workshop practices.
2. Students will be able to understand the practical difficulties encountered in manufacturing and assembly work in industries.
3. Ability to manufacture product as per drawing given.
4. Use gauging equipment to verify that a manufactured part fulfills the requirements specified on a manufacturing drawing
5. Adopt safety practices while working on various machines.

Text Books:

1. Workshop Technology I,II,III, by S K Hajra, and A K Chaudhary. Media Promoters and Publishers Pvt. Ltd., Bombay
2. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
3. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

Course Code: GA 1006, GA 2006, GA 3006, GA 4006

Course title: PT & Games

Credits:	**L**	**T**	**P**	**C**
	0	0	2	1

Course Objectives:

1. To develop Physical & Physiological Fitness
2. To develop social health and interaction with each other
3. To develop resistance power of the body
4. To develop knowledge related to Anatomy, Physiology and Biomechanics

Course Outcomes:

1. P.T. & Games gives healthy environment with respect to physical, mental & social development.
2. Students gets mental relief through sports activities.
3. Development of leadership quality.
4. Learn discipline, behaviour and punctuality during class hours.
5. Development of healthy environment inside & outside the sports complex.

Semester: 2

Course code: MA2201
Course title: Advanced Engineering Mathematics

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): basics of algebra, calculus, trigonometry, coordinate geometry, topics covered in engineering mathematics
Class schedule per week: 4 classes per week

Course Objectives: This course enables the students to:

1. learn the methods for solving linear differential equations of second and higher order
2. deal with some special functions as Legendre's and Bessel's function with introduction to Hermite, Chebyshev and Hypergeometric equations
3. expansion of the functions in the series of sine and cosine terms i.e. Fourier series
4. understand the theory of functions of a complex variable, complex differentiation and integration
5. deal with the infinite series (Taylor and Laurent series) for complex variable function, the theory of residues with applications to evaluation of integrals
6. study the methods for solving partial differential equations of first order and higher order with their applications as wave equation, heat equation etc

Syllabus:
Module I
Linear Differential Equations of Higher Order with constant coefficients Differential Equations with Variable Coefficients: Reducible to Equations with Variable Coefficients:- Cauchy – Euler Differential Equation. Legendre Linear Differential Equation. Solution of Differential Equation by transformation (or, change) of Independent Variable.
Module II
Reduction of Differential Equation to Normal Form (by reducing the order of the Differential Equation). Solution by the method of Variation of Parameters. Series Solution of differential Equations.
Module III
Bessel's differential Equation and its General solution**.** Bessel's Functions and its properties. Legendre's Differential Equation and Legendre Polynomials. Properties of Legendre Polynomials. Introduction to Hypergeometric Equation. Introduction to Hermite Differential Equations. Introduction to Chebyshev Polynomials.
Module IV
Eigen Values and Eigen Functions. Sturm – Liouville Problems.
Periodic Functions. Dirichlet's Conditions on Fourier Series. Euler's Formulae for Fourier Coefficients. Half – range Series. Fourier Series of Functions with Arbitrary period.
Module V
Function of Complex Variables. Limit, Continuity, Differentiability of a Complex Variable. Cauchy – Riemann Differential Equations in Cartesian and Polar Forms. Analytic Function. Cauchy's Integral Theorem. Cauchy's Integral Formula.
Module VI
Taylor Series, Laurent Series. Residues, Poles, Residue Theorem. Residue at Poles. Contour Integrals of Trigonometric $(0 \text{ to } 2\pi)$ and Algebraic Equations $(-\infty \text{ to } \infty)$. Conformal Mapping and Bilinear Transformation.
Module VII
Partial Differential Equation, Lagrange's Method, Homogeneous and Non-homogeneous Higher Order Equations (with Constant Coefficients). One - dimensional Heat Equation. One - dimensional Wave Equation.

Course Outcomes:
After completion of the course, the learners will be able to:

1. investigate the occurrence of differential equations in science and engineering
2. model any real life problem mathematically in terms of differential equations.
3. solve and analyze the real life problems mathematically with conclusions according to the physical nature of the problem.

4. apply special functions like Bessel, Legendre etc. to physical systems with cylindrical and spherical symmetry using
5. analyze the electrical, electromagnetic signals etc. with the help of Fourier series expansions of functions.
6. gain an understanding on physical problems involving fluid flow, steady state heat flow, electrostatics, magnetism, current flow etc. using complex variable theory (conformal mapping, analytic functions etc.)
7. develop the ability to deal with the problems of fluid mechanics, electromagnetic field, human body, neuro dynamics, image processing, quantum computation etc. using the theory of partial differential equations and their solutions.

Text Books:

1. Simmons G. F., Differential Equations with Applications and Historical Notes, TMH, 2nd ed., 2003.
2. R. V. Churchill and J. W. Brown, Complex Variables and Applications, 8th ed., 2009, McGraw – Hill.
3. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, 4th ed.2011.
4. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th ed., 1999

Reference Books:

1. Edwards and Penney, Differential Equations and Boundary Value Problems, Pearson Edu., 3rd ed.
2. Shepley L. Ross, Differential Equations Wiley India Pvt. Ltd., 3rd ed.
3. Birkhoff and Rota, Ordinary Differential Equations, Wiley India Pvt. Ltd., 4th ed.
4. Zill, Differential Equations, Thomson Learning, 5th ed., 2004
5. A.D. Wunsch, Complex Variables with Applications, Pearson Education Inc., 3rd ed.
6. M.J. Ablowitz and A.S.Fokas, Complex Variables Introduction and Applications, Cambridge Texts, 2nded.

Course code: EE2201
Course title: Principles of Electrical Engineering

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisites: Fundamental of Mathematics & Physics
Class schedule per week: 4 classes per week
Course Objectives:
This course enables the students to:

1. list and discuss types of circuit elements, measuring instruments and their principles;
2. represent series / parallel electric / magnetic circuits;
3. relate comprehensive knowledge of DC/AC networks in order to schematize electric and magnetic circuits;
4. explain and evaluate the performance of 1-φ and 3-φ (balanced/unbalanced) circuits for various applications such as transmission, distribution, generation of electrical energy.

Syllabus:
MODULE – I
Introduction: Importance of Electrical Engineering in day-to-day life, Electrical elements and their classification, Ideal and Real Sources, Source Conversion, KCL and KVL, Loop current and Nodal voltage method-for D.C. Circuits: Steady state analysis with independent and dependent sources; Series and Parallel circuits, Star-Delta conversion.
MODULE – II
A.C. Single-Phase Series Circuits: Common signals and their waveforms, RMS and Average value. Form factor & Peak factor of sinusoidal waveform. Impedance of Series circuits. Phasor diagram. Active Power. Power factor. Power triangle.
MODULE – III
A.C. Single-Phase Parallel Circuits: Admittance method, Phasor diagram. Power. Power factor. Power triangle, Series- parallel Circuit, Power factor improvement, Series and Parallel Resonance, Resonance curve , Q –factor, Dynamic Impedance, and Bandwidth.
MODULE – IV
Circuit Theorems: Superposition theorem, Thevenin's & Norton's theorem, Maximum Power Transfer theorem for Independent and Dependent Sources in DC as well as AC circuit.
MODULE – V
Three Phase Circuits: Line and Phase relation for Star and Delta connection, Power relations, Analysis of balanced and unbalanced 3 phase circuits.
MODULE – VI
Magnetic Circuits: Introduction, Series-parallel magnetic circuits, Analysis of Linear and Nonlinear magnetic circuits, Energy storage, A.C. excitation, Eddy currents and Hysteresis losses.
MODULE – VII
Coupled Circuits (Dot rule), Self and mutual inductances, Coefficient of coupling. Basic Indicating Instruments: Moving coil and moving iron type instruments.

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

1. conceptualize phasor representation for voltage, current, leading to construction of impedance, and power triangles;
2. classify basic electrical measuring instruments;
3. illustrate methods for power factor improvement of 1 – Φ and 3 – Φ circuits;
4. integrate and evaluate electric & magnetic circuits using various approaches including network theorems, network reduction techniques, resonance phenomena, etc.;

5. collaborate electric & magnetic circuit theory and convincingly appeal the society at large to save electrical energy.

Text Books:

1. Hughes Electrical Technology, Revised by McKenzie Smith, Pearson.
2. Fitzgerald and Higginbotham, Basic Electrical Engineering, McGraw Hill Inc, 1981.

Reference Books:

1. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 3rd Edition, TMH, New Delhi, 2009.
2. W. H. Hayt, Jr J. E. Kemmerly and S. M.Durbin, Engineering Circuit Analysis, 7^{th} Edn TMH, 2010.
3. Electrical Engineering Fundamental, Vincent Del Toro, Prentice Hall, New Delhi.

Course code: CH 2203
Course title: Environmental Science

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): High school level chemistry
Class schedule per week: 3 classes per week
Course Objectives: This course enables the students:

1. To comprehend the multidisciplinary nature of environment
2. To identify the various pollutants present in environment and trace their path through the various components of the environment
3. To assess the impact of multifarious human activities on various environmental segments
4. To evaluate the environmental monitoring and control measures and sustainable environmental practices being implemented at various levels

Syllabus:

Module I: Introduction to Environmental Science

Environmental Awareness, Concept of an ecosystem, structure and function of an ecosystem, energy and nutrient flow, biogeochemical cycles, sources, pathways and fate of environmental pollutants.

Module II: Atmosphere & Air Pollution

Introduction, Segments of environment, Layers of atmosphere and their significance; Mechanism, Causative factors, Consequences and Preventive measures – Ozone depletion, Green house effect and Global warming; Earth's radiation budget, Classification of air pollutants, Indoor air pollution, Smog-photochemical and sulphurous, Acid rain, Air Quality Standards, Human health effects

Module III: Air Pollution Monitoring & Control

Pollution Sources: Stationary & Mobile emission Sources, Monitoring & Control of air pollutants using high volume sampler, cyclone separators, wet scrubbers, electrostatic precipitators, etc. automobile emission control.

Module-IV: Water Pollution

Water Resource; Water Pollution : Definition, Classification , Sources of Contamination, Pollutants & their Detrimental Effects; Water Quality: Portability limit – WHO and PHED Specification; Water Quality Monitoring, Municipal Water Treatment: Slow and Rapid Sand Filter, Disinfection – Methods, Advantages & Disadvantages, Sterilization

Module V: Industrial & Waste Water Treatment

Industrial Water: Specification of boiler feed water, internal and external treatment, ion exchange process, electro-dialysis, and reverse osmosis. Sewage Treatment: composition, aerobic and anaerobic treatment, chemical and biological oxygen demand

Module VI: Soil and Noise pollution

Lithosphere and Soil profile, Soil contamination, sources of soil contamination,Important environmental properties of soil contaminants, Ecological & Health effects, Exposure & Risk Assessment. Brief introduction to noise pollution, source, measurement and prevention of noise pollution

Module VII: Radioactive Pollution & Solid Waste Management

Radioactive pollutant: units of radiation and instruments for their measurements, types of radioactive pollutants and risk factor associated with these radiations Radioactive waste and their disposal, accidental leakage of radiation from nuclear reactors (discuss Chernobyl and Fukushima). Solid waste management- different types of solid waste, composting, biological methods of detoxification of hazardous waste Onsite handling and composting, integrated solid waste management, Environmental Impact Assessment

Course Outcomes:

After completion of the course, the learners will be able to:

1. Comprehend the basic structure of the environment and relate to the interdependence of one component on another
2. Knowing the origin and nature of the pollutant , trace the movement of these pollutants in various components of the environment
3. identify and analyze the impact of human activities on the environment
4 Evaluate the measures being taken for monitoring and control of environmental pollutants
5 Inculcate and imbibe sustainable and greener alternatives in every walk of life.

Text Books:

1. Environmental Science by G.Tyler Miller Jr. Wadsworth Publishing House, USA
2. Introduction to Environmental Science and Engineering : G.M, Masters

Reference Books:

1. Environmental Chemistry : A.K. De, : New Age International (P) Ltd. Publishers.
2. Basic Concepts of Environmental Chemistry : D. W. Connell
3. Atmospheric Science : P.W.Wayne
4. Sampling and analysis of environmental Pollutants: Baskin and Radjovick

Course code: CS 2301
Course title: Fundamentals of Data Structures

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisites: Knowledge of Programming languages like C/C++
Class schedule per week: 4 classes per week

Syllabus:

MODULE – I

Algorithms and Analysis of Algorithms: Definition, Structure and Properties of Algorithms, Development of an Algorithm, Data Structures and Algorithms, Data Structure – Definition and Classification, Efficiency of Algorithms, Apriory Analysis, Asymptotic Notations, Time Complexity of an Algorithm using O Notation, Polynomial Vs Exponential Algorithms, Average, Best and Worst case Complexities, Analyzing Recursive Programs, Open source software development process.

MODULE – II

Arrays, Stacks and Queues: Array Operations, Number of Elements in an Array, Representation of Arrays in Memory, Applications of Array, Stack-Introduction, Stack Operations, Applications of Stack, Queues-Introduction, Operations on Queues, Circular Queues, Other Types of Queues, Applications of Queues.

MODULE – III

Linked List, Linked Stacks and Linked Queues: Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Multiply Linked Lists, Applications of Linked Lists, Introduction to Linked Stack and Linked Queues, Operations on Linked Stacks and Linked Queues, Dynamic Memory Management and Linked Stack, Implementations of Linked Representations, Applications of Linked Stacks and Linked Queues.

MODULE – IV

Trees, Binary Trees, BST, AVL Trees and B Trees: Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees: Basic Terminologies and Types, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Applications, BST & AVL Trees: Introduction, BST: Definition and Operations, AVL Trees: Definition and Operations, B Trees: Introduction, m-way search trees: Definition and Operations, B Trees: Definition and Operations.

MODULE – V

Graphs: Introduction, Definitions and Basic Terminologies, Representations of Graphs, Graph Traversals, Single-Source Shortest-Path Problem, Minimum Cost Spanning Trees.

MODULE – VI

Sorting: Introduction, Shell Sort, Quick Sort, Heap Sort.

MODULE – VII

Searching: Introduction, Binary Search, Transpose Sequential Search, Interpolation Search.

Course Outcomes: After completion of the course, the learners will be able to:

1. Understand the properties of various data structures
2. Identify the strength and weaknesses of different data structures
3. Design and employ appropriate data structures for solving computing problems
4. Analyze and compare the efficiency of algorithms
5. Think critically
6. Solve computing problems independently

Text Books:

2. G A V Pai – Data Structures and Algorithms: Concepts, Techniques and Applications, 2nd Edn, Tata McGraw-Hill, 2008
3. Horowitz E.Sahni, S., Susan A., Fundamentals of Data Structures in C, 2nd Edition, University Press, 2010

Reference Books:

1. J. P. **Tremblay** , P. G. **Sorenson – An Introduction to Data Structures With Applications, 2nd Edn,** McGraw-Hill, Inc. New York, NY, USA.
2. Seymour Lipschutz – Data Structures, 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
3. Adam Drozdek – Data Structures and Algorithms in C++, Thomson Learning, New Delhi – 2007.
4. J. Feller, B. Fitzgerald -Understanding Open Source Software Development, Pearson Education Ltd. New Delhi

Course code: EC2001

Course title: Principles of Electronics Engineering

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge of active and passive components, KVL and KCL, knowledge of semiconductors

Classes scheduled per week: 3 classes per week

Course Objectives:

1. To help them understand diodes, filters and its applications
2. To help them understand transistors and its applications
3. To help them understand the operational amplifier and its applications
4. To help them design of logic circuits and their applications

Syllabus:

Module – 1:

RC Filters, Diodes and their applications: RC Filters, Diode and their types, Rectifiers, Filters, Clipper, Clamper, Zener diode and its applications.

Module – 2:

Bipolar Junction Transistors: CB, CE, CC Configurations, Operating point, Biasing circuits, Bias Stability, Thermal runway and thermal stability.

Module – 3:

Transistor Analysis

Transistors at low frequencies: Two port devices and the Hybrid model, General analysis of an amplifier using h parameters, analysis of CE, CB and CC amplifiers.

Transistors at high frequencies: Hybrid Π model, Amplifier response at high frequencies, Gain- Bandwidth product

Module – 4:

Amplifiers and Oscillators:

Amplifiers: Concept of negative feedback, Voltage series, Voltage shunt, Current series and Current shunt feedbacks

Oscillators: Concept of positive feedback, Barkhausen criterion, RC Phase shift oscillator, Wein bridge oscillator, Hartley, Colpit and Crystal oscillators.

Module – 5:

Field Effect Transistors and Transistor Power amplifiers

Field Effect Transistors: FET & MOSFET, characteristics, biasing and small signal low frequency analysis of CD, CS and CG configurations

Transistor Power Amplifier: Circuits and operations of class-A, Class-B and Class-C amplifiers, Push–Pull amplifiers

Module – 6:

Operational amplifiers and its applications: Characteristics, Parameters, Measurements, Emitter Coupled Differential Amplifier, Transfer Characteristics, Voltage gain, Inverting and Non-inverting amplifiers, Voltage follower, Phase inverter, Scale changer, Integrator and Differentiator circuits.

Module – 7:

Logic circuits and Applications: Logic circuit implementation using diodes and transistors, Basic concept of TTL, ECL and CMOS logic circuits.

Course Outcomes:

After completion of this course, learners will be able to:

1. Analyze diodes, Zener diode, rectifiers, clippers, clampers and filters
2. Design and analyze Bipolar transistor at low frequency and high frequency in CC,CB,CE modes
3. Analyze and characterize the FET and MOSFETs
4. Design and analyze the Operational amplifier
5. Design, analyze and characterize the logic circuits

Text Books:

1. “Integrated Electronics” Millman & Halkias, McGraw Hill
2. “Pulse Digital and Switching waveforms” JacubMillman and H. Taub, McGraw Hill Pub
3. “Operational Amplifiers and Linear Integrated Circuits” by R. A. Gayakwad, PHI
4. ”Digital Logic and Computer Design “M. Mano. PHI

Reference Books:

1. “ The Art of Electronics”, Paul Horowitz and Winfield Hill, Cambridge University Press
2. “Electronic Devices and Circuit Theory”, Nashelesky & Boylestead, PHI/Low price edition.

Course code: ME 2001
Course title: Principles of Mechanical Engineering

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week

Syllabus:

Module 1: Non-Conventional Energy and their resources: Energy sources; Renewable and Non-renewable Energy Resources; Advantages and Disadvantages of Renewable Resources; Renewable Energy Forms and Conversion; Solar Energy; Wind Energy; Tidal Energy; Ocean Thermal Energy; Geothermal Energy; Nuclear Energy; Hydro Energy.
Module 2: Properties of pure substance, Boiler Mountings and Accessories: Definition; Function; Classification; Fire Tube and Water Tube Boilers; Cochran Boiler; Lancashire Boiler; Locomotive Boiler; Backcock and Wilcox Boiler; Packaged Boilers; High Pressure Boilers. Boiler Mountings & accessories.
Module 3: Internal Combustion Engines: Classification of I.C. Engines, Petrol engine; Diesel engine; Gas Engine, Two- stroke & Four- stroke engine, C.I. Engines and S.I. Engines.
Module 4: Heat transfer; various modes of heat transfer, one-dimensional steady state conduction. Application to composite walls and cylinders
Module 5: Simple stresses and strains, Hooke's Law elasticity, Relation between elastic constants, Thermal Stresses.
Module 6: Transmission of Power: Transmission systems; Belt Drives; Flat belt; V-Belt; Limiting Tensions ratio, Chain drives; Gear Drives; Rope Drives; Types of gears; Gear Trains: Simple, compound and epicyclic gear trains.
Module 7: Vibrations, Types of Vibrations, Free undamped longitudinal vibrations, Free damped longitudinal vibrations.

Course Outcomes:
At the end of the course the student will –

1. have knowledge of different sources of energy as well as power plants for the conversion of available energy into electrical energy.
2. know about basic parts and types of the boilers and its performance parameters for the safe and efficient working of the thermal power plant.
3. be able to have general idea about the Internal Combustion Engines and its working.
4. be able to solve one-dimensional heat conduction problems of plane and cylindrical walls.
5. be able to solve problems related to materials, power transmission drives and vibration systems.

Text Books:

1. Fundamentals of Classical Thermodynamics – G.J. Van Wylen and R.E. Sorntag, Second Edition, Wiley Eastern (1984).
2. An Introduction to Thermodynamics – P.K. Nag
3. Thermal Engineering – R.K. Rajput

Reference Books:

1. Strength of Materials – F.L. Singer
2. Theory of Machines – Thomas Beven

SESSIONAL / LABORATORY:

Course code: CH 1402
Course title: Chemistry Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Knowledge of basic chemistry practical
Class schedule per week: 3 classes per week
Course Objectives:

1. An integrated laboratory course has been designed to expose the students to classical methods of analysis as well as modern instrumentation methods.
2. The students will be exposed to conventional volumetric, Gravimetric techniques, highlighting the importance of sample and solution preparation, precision and sensitivity of analytical techniques.
3. The students will learn various instrumental techniques e.g. spectroscopy, calorimetry, viscosity measurements by Redwood viscometer etc.
4. The students will learn good laboratory practices and safety measures.

List of Experiments:

1. Determination of total hardness in a given water sample (complexometric Titration).
2. Determination of Dissolved Oxygen (DO) in a given water sample (Winkler's meyhod) & verification using DO metre in potable water analyzer.
3. Determination of Free Chlorine in a given sample of water (Iodometric Titration). Determination of total Alkalinity of a given sample of water.
4. Characterization and identification of an unknown compound using FTIR Spectrometer
5. Estimation of Total iron in a given sample of water using spectrophotometer.
6. Determinations of Gross Calorific Value of a fuel using Junker's gas/Bomb Calorimeter.
7. Determination of percentage composition of flue gas using Orsat apparatus.
8. a) Determination of Open Flash Point of a given sample of oil using Cleveland's apparatusb) Determination of Closed Flash Point of a given sample of oil using Abel's apparatus
9. To determine the viscosity of oil at room temperature using Redwood viscometer and to calculate the absolute viscosity (poise).
10. Determination of rate or velocity constant for the hydrolysis of ethyl acetate.
11. Proximate Analysis of a given sample of solid fuel (% of moisture, volatile combustible matter, ash and fixed carbon).
12. Estimation of pH of a given sample of water using colorimeter.

Course Outcomes:
A graduate shall

1. be competent in applying practical knowledge forwater analysis.
2. be competent in applying practical knowledge to understand the solid and liquid fuel quality, environment pollutant including the determination of CO and CO2 level.
3. be competent to use the instrumental technique for spectroscopic analysis.
4. be competent to use the volumetric analysis.

Text Books:

1. Experiments in Applied Chemistry — S. Rattan
2. Experiments in Engineering Chemistry — S. Chawla

Reference Books:

1. Engineering Chemistry Practical: — H Joshua Phillips

Course code: CS2302
Course title: Data Structure Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Knowledge of programming languages like C/C++.
Class schedule per week: 3 classes per week
Course Objectives: This course enables the students to:

1. develop capability to comprehend the fundamentals of Production and Industrial Engineering for application to engineering problems.
2. produce skilled and competent graduates capable of facing the challenges of real life and engineering practices
3. enabling graduates to have command over various manufacturing processes and machine tools
4. develop an attitude for continuous learning and aspiration to excel in all endeavors.
5. improve inter-personal skill, team spirit and employability while believing on the ethical values.

List of Experiments:

1. Write a program to create a one dimensional array at run time using a user defined function with user given number of elements into it. Also write separate functions that would allow you to insert and delete elements into/from this array at any arbitrary location.
2. WAP to add and subtract following polynomials $5x^2 – 3xy + y$, $2x^2 – y^2 + 5xy – x + y$ using array.
3. Write a program to create one dimensional, two dimensional and three dimensional arrays in memory and then verify the various address calculation formulae for any arbitrary element of these arrays.
4. Write a program to obtain a sparse matrix representation B for the matrix A given below

0	1	0	0	0	0
0	0	0	0	0	0
-2	0	0	1	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	-3	0	0	0	0
0	0	0	0	0	1

5. Write a program to create an ordered list $L[d_1, d_2, \ldots d_n]$ where each d_i is the name of a peripheral device, which is maintained in the alphabetical order. Write functions to
    a. Insert a device d_k onto the list L.
    b. Delete an existing device d_i from L. In this case the new ordered list should be $L^{new} = (d_1, d_2, \ldots d_{i-1}, d_{i+1}, \ldots d_n)$ with $(n – 1)$ elements.
    c. Find the length of L.
    d. Update the device d_j to d_k and print the new list.
6. Write a program to implement a stack in an array and perform PUSH, POP, PEEP and CHANGE operations on it using functions.
7. WAP to convert the following expression to its postfix equivalent using stack
    a. ((A + B)* D) ^ (E – F)
    b. A + (B * C – (D / E ^ F) * G) * H Where ^: raise to the power
8. Implement a stack S of n elements using arrays. Write functions to perform PUSH and POP operations. Implement queries using push and pop functions to
    a. Retrieve the m^{th} element of the stack S from the top ($m < n$), leaving the stack without its top $m – 1$ elements.
    b. Retain only the elements in the odd position of the stack and pop out all even positioned elements.
9. Implement a program to evaluate any given postfix expression. Test your program for the evaluation of the equivalent postfix form of the expression (- (A*B)/D) ↑ C + E – F * H * I for A = 1, B = 2, D = 3, C = 14, E = 110, F = 220, H = 16.78, I = 364.621.
10. WAP to implement linear queue using array and linked list.

11. WAP to implement circular queue using array and linked list.
12. WAP to declare a priority queue using two-dimensional array, store elements and priority. Display the elements according to priority from higher to lower.
13. A deque DQUE is to be implemented using a one dimensional array of size N. Write functions to:
    a. Insert and delete elements from DQUE at either ends.
    b. Implement DQUE as input restricted deque.
    c. Implement DQUE as output restricted deque.
14. Write a menu driven program to perform the following operations on a singly linked list.
    a. Create
    b. Insert
    c. Delete
    d. Display
    e. Exit.
15. WAP to create a sorted one way linked list with n nodes. Extend the program to insert a new node at appropriate location so that order does not get disturbed.
16. WAP to create a circular list and then count the number of nodes into it.
17. WAP to implement doubly linked list having facilities to insert a node at any position and to delete a node with particular information.
18. Let $X = (x_1, x_2, \ldots x_n)$, $Y = (y_1, y_2, \ldots y_n)$ be two lists with a sorted sequence of elements. Write a program to merge the two lists together as a single list Z with m + n elements. Implement the lists using singly linked list representations.
19. Write a program which will split a circularly linked list P with n nodes into two circularly linked lists P_1, P_2 with the first $\lfloor n/2 \rfloor$ and the last $n - \lfloor n/2 \rfloor$ nodes of the list P in them, respectively.
20. Write a menu driven program which will maintain a list of car models, their price, name of the manufacturer, engine capacity etc., as a doubly linked list. The menu should make provisions for inserting information pertaining to new car models, delete obsolete models, and update data such as price besides answering queries such as listing all car models within a price range specified by the user and listing all details given a car model.
21. WAP to evaluate a postfix expression using a linked stack implementation.
22. WAP for creation of binary tree and traverse it in Pre, Post and Inorder. Show the traversal output.
23. WAP to construct an expression tree for a given arithmetic expression, check its correctness by traversing it in inorder.
24. WAP to count the no. of leaf nodes in a binary tree.
25. Write non-recursive functions to perform the inorder, preorder and postorder traversals of a binary tree.
26. Implement a menu driven program to perform the following operations on a binary search tree:
    a. Construct a BST (Construction begins from an empty tree)
    b. Insert element(s) into a non empty BST
    c. Delete element(s) from a non empty BST
    d. Search for an element in a BST
    e. Retrieve elements of the BST in the sorted order.
27. WAP to input a graph $G = (V, E)$ as an adjacency matrix. Include functions to
    a. Test if G is complete.
    b. Obtain the degree of a node u, if G is undirected, and indegree and outdegree of node u if G is directed.
28. WAP to input a graph $G = (V, E)$ as an adjacency list. Include two functions BFT and DFT to undertake breadth first traversal and depth first traversal of the graph.
29. WAP to implement Shell sort, Quick sort and heap sort for any arbitrary set of elements with the help of user defined functions.
30. Implement a binary search on an ordered list. For the list L = {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20} undertake search for the elements in the list {3, 18, 1, 25}. Compare the number of key comparisons made during the searches.

Course Outcomes: After completion of the course, the learners will be able to:

1. Understand the properties of various data structures.
2. Identify the strength and weaknesses of different data structures
3. Design and employ appropriate data structures for solving computing problems

4. Analyze and compare the efficiency of algorithms
5. Think critically

Text Books:

1. G A V Pai – Data Structures and Algorithms: Concepts, Techniques and Applications, 2nd Edn, Tata McGraw-Hill, 2008
2. Horowitz E.Sahni, S., Susan A., Fundamentals of Data Structures in C, 2nd Edition, University Press, 2010

Reference Books:

1. J. P. **Tremblay** , P. G. **Sorenson – An Introduction to Data Structures With Applications, 2nd Edn,** McGraw-Hill, Inc. New York, NY, USA.
2. Seymour Lipschutz – Data Structures, 6th Edn, 9th Reprint 2008, Tata McGraw-Hill.
3. Adam Drozdek – Data Structures and Algorithms in C++, Thomson Learning, New Delhi – 2007.
4. J. Feller, B. Fitzgerald -Understanding Open Source Software Development, Pearson Education Ltd. New Delhi.

Course code: EC2002

Course title: Basic Electronics Engineering lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Class schedule per week: 3 classes per week

Course Objectives: This course enables the students to:

1. Study of characteristics and finding the parameters of different electronics components.
2. Design different types of rectifier and RC oscillator circuits.
3. Study of frequency response of different amplifiers and band pass filter.
4. Implement different digital gates using universal gate.
5. Design the basic analog and digital circuits using Multisim software.

List of experiments:

1. Design a RC Band Pass filter circuit and find out its bandwidth.
2. Determine forward bias and reverse bias characteristics of a PN junction diode
3. To determine ripple factors of the half wave and full wave rectifier circuit with the following condition
   a) With C b) With LC c) With CLC filter
4. Study of Zener diode as a voltage regulator.
5. Study of CE transistor amplifier and measurement of its bandwidth.
6. Determine the h-parameters h_{ie} and h_{fe} of a transistor
7. Design a RC phase shift oscillator and finding out its frequency of oscillation.
8. Design a Wein bridge oscillator and finding out its frequency of oscillation.
9. Design a NON –inverting amplifier using IC 741 OP-AMP and finding out its Gain bandwidth product.
10. Design an inverting amplifier using IC 741 OP-AMP and finding out its Gain bandwidth product.
11. Design a differential amplifier using IC 741 OP-AMP find out its CMRR
12. Implement and verify the truth table of following gates using IC 7400
    a) NOT b) AND c) OR d) XOR

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

1. Demonstrate the acquired knowledge of various concepts of basic electronics by its practical implementation.
2. Characterize and compute the different parameters of electronics components.
3. Determine the frequency response of different analog circuits.
4. Design different digital circuits using universal gates.
5. Efficiently use software (Multisim) to design practical application based analog and digital circuits.

Text Books:

1. "Pulse Digital and Switching waveforms" Jacub Millman and H. Taub, McGraw Hill Pub.
2. "Integrated Electronics" Millman & Halkias, McGraw Hill
3. "Operational Amplifiers and Linear Integrated Circuits" by R. A. Gayakwad, PHI
4. "Digital Logic and Computer Design", M. Mano. PHI
5. "The Art of Electronics", Paul Horowitz and Winfield Hill, Cambridge University Press

Reference Books:

1. "Electronic Devices and Circuit Theory", Nashelesky & Boylestead, PHI/Low price edition.

Semester: 3

Course code: BT 3021
Course title: Biological Science

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week
Course Objectives

1. Students will understand evolution: how it occurs and how it explains the unity and diversity of life.
2. Students will demonstrate a broad, comprehensive knowledge of the main areas of biology.
3. Student will be able to apply this knowledge to address new questions.
4. Students will be familiar with appropriate quantitative tools and technology to test hypotheses that address biological questions.

Syllabus

Module I

Nature of living things: Definition of life, Miller's experiment, theories and evidences about origin of life, levels of biological organization, classification of living world.

Module II

Biomolecules: composition of living matter, water, carbohydrates, lipids, proteins, nucleic acids, vitamins and minerals.

Module III

Biochemistry: Bioenergetics and thermodynamics, biological oxidation-reduction reactions, glycolysis, citric acid cycle, fatty acid metabolism, electron transport chain, aerobic and anaerobic respiration

Module IV

Molecular organization of cell: Viruses, cellular structure of microorganism, animal and plant, salient features of intracellular organelles, cell division and cell cycle, structure of chromosomes, difference between prokaryotes and eukaryotes.

Module V

Molecular biology: Structure of DNA and RNA, DNA as genetic material, central dogma of molecular biology, DNA replication, transcription and translation, Introduction to bioinformatics and drug designing.

Module VI

Enzymology:Mechanism of enzyme action, Lock and key model and induced fit model, active site, Michaelis Menten equation, reversible and irreversible inhibitors, competitive, non-competitive and uncompetitive inhibition.

Module VII

Techniques in biological sciences: Centrifugation, chromatography, gel electrophoresis, spectroscopy, thermal analysis

Course Outcomes:

1. Students will be able to understand the concept of life and its evolution.
2. Students will be able to define and explain major concepts in the biological sciences.
3. Students will be able to communicate biological knowledge in oral and written form.
4. Student will be able to recognize the relationship between structure and function at all levels: molecular, cellular, and enzymatic.
5. Students will be able to understand the structure and function of enzymes.

Course code: EE3201

Course title: Introduction to System Theory

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Basic knowledge of Mechanics, Mathematics and Principles of Electrical Engineering.

Class schedule per week: 3 classes per week

Course Objectives: This course enables the students:

1. to outline the fundamentals of common signals, systems and recall interpret the list of electrical and non-electrical components
2. to summarize different transform methods, state-space techniques and different stability conditions of linear time-invariant system using Routh-Hurwitz criteria
3. to analyze the transient and steady-state performance of first-order and second order systems when subjected to different standard signals and also the absolute stability using above criterion.
4. to actualize the electrical, mechanical, hydraulic and thermal systems using differential equations, transfer functions and state variables

Syllabus:

MODULE I:
Introduction to signals and Systems: Definition, Basis of classification, Representation of common signals and their properties, system modeling.
MODULE II:
Analogous System: Introduction, D Alembert's Principle, Force – voltage and Force – Current analogies, Electrical analogue of mechanical, hydraulic and Thermal systems.
MODULE III:
Fourier Transform Method: Introduction, Fourier Transform pair, Amplitude spectrum and phase spectrum of signals, Sinusoidal transfer function.
MODULE IV:
Laplace Transform Method: Introduction, Laplace Transform pair, Laplace Transformation of common functions, Gate function, Step function and Impulse function, Laplace Theorems: shifting, initial value, final value and convolution theorems. Inverse Laplace Transform by partial fraction expansion and convolution integral method.
MODULE V:
System Analysis: System Analysis by Laplace Transform Method, System response, Natural, forced, transient and steady state responses, Transfer function and characteristic equation, Superposition integral, Concept of poles and zeros, Nature of system response from poles and zeros.
MODULE VI:
System Stability: Concept of stability, Types, Necessary and sufficient conditions, Routh-Hurwitz stability criterion, Limitations and its applications to closed-loop systems.
MODULE VII:
State-Space Concept: Introduction, Definition: State, State variable, State vector and state space, State space representation, Derivation of State model from transfer function, Bush form and Diagonal canonical form of state model, Non-uniqueness of state model, Derivation of transfer function from state model, Transition Matrix and its properties, Solution of time-invariant state equation.

Course Outcomes:

After the completion of this course, students will be able to:

1. describe characteristics of different signals and systems
2. interpret the transform domains like Laplace equations, concept of poles and zeros, Fourier equations and time-domain state-space techniques
3. solve mathematical model of electrical and non-electrical components with the knowledge of system science, related mathematics of simple engineering problems and concept of analogous quantities.

4. relate Laplace equations, Fourier equations and time-domain state-space techniques to solve any given linear ordinary differential equations and analyze transient and steady-state performance of a first order and second order linear time-invariant system using standard test signals
5. evaluate and formulate electrical or non-electrical linear time invariant systems for desired transient behavior, steady state errors and stability

Text Books:

1. Analysis of Linear Systems – D.K.Cheng, Narosa Publishing House, Indian Student Edition.
2. Control System Engineering – Nagrath & Gopal, New Age International Pvt. Ltd., New Delhi, 2nd edition.

Reference Books:

1. Networks and Systems – D. Roy Choudhury, New Age International Pvt. Ltd., New Delhi, 2010.
2. Signals and Systems - Simon Haykin, Wiley 2nd Ed., 2002.
3. Linear Systems and Signals – B.P.Lathi, 2nd Ed., Oxford University Press, 2004.

Course code: EE3205
Course title: Network Theory

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): Basic theorems of Principle of Electrical Engineering

Class schedule per week: 4 classes per week

Course Objectives: This course enables the students:

1. to list the properties and discuss the concepts of graph theory
2. to solve problem related to network theorems.
3. to illustrate and outline the Multi- terminal network in engineering
4. to select and design of filters

Syllabus:

MODULE I
Network Theorem: Substitution theorem, Tellegen's theorem, Reciprocity theorem
MODULE II
Network Topology: Definition and properties, Matrices of Graph, Network Equations & Solutions: Node and Mesh transformation, Generalized element, Source transformation, Formulation of network equations, Network with controlled sources, Transform networks, Properties of network matrices, Solution of equations. Linear time-invariant networks, Evaluation of initial conditions, Frequency and impedance scaling.
MODULE III
Multi-terminal Networks: Natural frequency, Network functions, Two-port parameters, Equivalent networks.
MODULE IV
Elements of Network Synthesis: Positive real function, Reactance functions, RC functions, RL Network, Two-port functions, Minimum phase networks.
MODULE V
Approximation: Filter specifications, Butterworth approximation, Chebyshev approximation, Comparison between Butterworth and chebyshev transfer functions.
MODULE VI
Bandpass filter approximation, Frequency transformation, Insertion Loss Synthesis: Coefficient matching technique, Darlington's method.
MODULE VII
Active Networks and Filters: Active elements, Single amplifier filters, State variablerealization, All pass and notch filter, Higher order filter.

Course Outcomes:

After the completion of this course, students will:

1. be able to solve problems related to DC and AC circuits
2. become adept at interpreting network analysis techniques
3. be able to determine response of circuits consisting of dependent sources
4. analyze linear and non linear circuits
5. be able to design the filters with help of Electrical element

Text Books:

1. V.K. Aatre, Network Theory & Filter Design, New Age International Pvt. Ltd., New Delhi.

Reference Books:

1. M.E. Van Valkenberg, Introduction to Modern Network Synthesis, John Wiley & Sons (1 January 1966).
2. Balabanian, N. and T.A. Bickart, “Electric Network Theory”, John Wiley & Sons, New York,1969.
3. C. L. Wadhwa, Network Analysis and Synthesis, New Age International Pvt. Ltd., New Delhi.

Course code: EE3207
Course title: Electric Energy Generation & Control

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Basic knowledge about working of alternator and electric power systems
Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students:

1. To enumerate the energy generation scenario and understand the principle of operation of different types of power generation systems
2. To relate the structure and principles of the controls related to electrical power generating stations.
3. To outline power generation from renewable energy sources and assess impact of such non-polluting energy conversion systems
4. To compare salient features of different generating stations and substantiate sustainable and economic generation

Syllabus:
MODULE I
Introduction: Overview of power generation scenario from thermal, hydro and nuclear and non-conventional sources.
MODULE II
Thermal Stations: Selection of site for a thermal station, layout, main components, boiler, economizer, air preheater, super heater, reheater, condenser, feed heater, cooling powers, FD and ID fans, Coal handling plant, water treatment plant, Ash handling plant, Types of boilers and theirs characteristics, Steam turbines, and their characteristics, governing system for thermal stations.
MODULE II
Hydro Electric Stations: Selection of site, layout, classification of hydro plants, general arrangement and operation of a hydro-plant, governing system for hydel plant, types of turbines.
MODULE IV
Nuclear Power Station: Nuclear reaction for nuclear power, nuclear fuels, feasibility of a nuclear power station, layout, main part of a nuclear station, nuclear reactor classification, control system for nuclear power station, Safety of nuclear power reactor.
MODULE V
Diesel Electric Station: Site selection, layout, main components, choice and characteristics of diesel engines, diesel engines, diesel plant efficiency and heat balance, maintenance.
MODULE VI
Gas Turbine Plant: Plant layout, a simple gas turbine plant, methods to improve thermal efficiency of a gas turbine plant, fuel for gas turbine plant, combined gas turbine cycle, advantages of gas turbine plants over steam plants.
MODULE VII
Non-conventional Sources of Energy and Economics of Power Generation: Wind, Tidal, Solar, and Load curve, Load factor, diversity factor, Plant capacity factor, Plant utilization factor, different types of tariffs, Inter connection of power system.

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

1. Outline the significance of various components of the power generation plants and explain the principle of their operation for bulk energy generation
2. Apply the basic knowledge of electric power generation as well as control related to real and reactive power for load-frequency and voltage control
3. Contrast and choose non-conventional energy sources for sustainable energy generation
4. Analyze and estimate different factors related to economics of generation and formulate different types of tariffs
5. Assess and integrate different power generation systems for interconnected operation.

Text Books:

1. Power Plant Engineering- PK Nag TMH publications
2. A Textbook on Power System Engg. – A Chakravarti, ML Soni, PV Gupta and U.S. Bhatnagar, Dhanpat Rai & Co., New Delhi

Reference Books:

1. Elements of Electrical Power Station Design – MV Deshpande, Pitman and Sons Ltd.
2. Electric Power Generation, Transmission and Distribution - S.M. Singh, Prentice Hall of India, Delhi.
3. Generation, Distribution and Utilization of Electrical Power – C.L. Wadhwa, New Age Publication.

Course code: **EC3201**
Course title: **Digital Electronics**

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): Fundamentals of basic electronics.
Class schedule per week: 4 classes per week
Course Objectives: This course enables the students:

1. to introduce binary logic, necessary for circuit level implementation.
2. to introduce digital systems and how it is necessary in our day to day life.
3. to give the basic tools for analyzing and designing of digital systems.
4. to cover all fundamental concepts for the designing of the digital system.

Syllabus

MODULE I:
Simplification of Boolean Expressions: Gate-level minimization, NAND and NOR implementation, POS & SOP simplification, Karnaugh map, Quine McCluskey method.
MODULE II:
Design of Combinational Circuits: Adders, Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, magnitude comparator, Parity Generators and Checkers, Signed number system, BCD adder/subtractor, carry look ahead adder
MODULE III:
Sequential Circuits: Basic Concepts, Flip-Flop, RS, JK, Master Slaves, T and D Flip-Flops, Controlled Registers, Shift Registers and their applications, Synchronous and asynchronous counters, Controlled Counters, Up/Down counters, Ring counter.
MODULE IV:
Analysis of Clocked Sequential Circuits: State equation, state table and state diagram, input equations, Analysis with various flip flop, State reduction and assignment, Design of clocked sequential circuits
MODULE V:
Introduction to Various Logic Families: Electrical characteristics of logic gates TTL gates, CMOS gates, Static CMOS Design; Dynamic hazards, Ratioed Logic, Pass-transistor logic, Transmission gate logic.
MODULE VI:
Multivibrators: Types of multivibrators, AMV, MMV and BMV using transistors, AMV and MMV using OP-AMP, Schmitt Trigger
MODULE VII:
Memories and Programmable Logic Devices: Memory organization and operation, write and read operations, Read only memories, PROMs, EPROMs, EEPROMs, RAMs: Static RAM, Dynamic RAM, Design of an 8x4 ROM, PLA, PAL, Generic array logic, CPLD, FPGA

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

1. understand the working of the various digital systems which are in use in our day to day life. The most important is the general purpose computer.
2. analyse and design any digital circuit.
3. with the knowledge of the fundamental tools, they will be in a position to attempt for the design of better digital systems than the existing ones.
4. independently build their innovative ideas into digital circuits
5. apply the knowledge to other interdisciplinary areas.

Text Books:

1. Digital Design, M. Morris Mano. Prentice Hall India
2. Modern Digital Electronics, R.P.Jain, TMH.

Reference Books:

1. A first course on Digital Electronics, Nigel. P. Cooper, PHI
2. Digital Fundamentals, Floyd, Pearson.

SESSIONAL / LABORATORY:

Course code: EE3202
Course title: Basic Electrical Engineering Laboratory

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Physics, Fundamentals of Mathematics and Electrical Engineering.
Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. To describe students practical knowledge of active and passive elements and operation of measuring instruments
2. To demonstrate electrical circuit fundamentals and their equivalent circuit models for both 1-φ and 3- φ circuits
3. To establish voltage & current relationships with the help of phasors and correlate them to experimental results
4. To conclude performance of 1 – Φ AC series circuits by resonance phenomena
5. To evaluate different power measurement for both 1-φ and 3- φ circuits

List of Experiments:

1. **Name: Measurement of low & high resistance of DC shunt motor**
   Aim: (i) To measure low resistance of armature winding of DC shunt motor
   (ii) To measure high resistance of shunt field winding of DC shunt motor
2. **Name: AC RLC series circuit**
   Aim: (i) To obtain current & voltage distribution in AC RLC series circuit
   (ii) To draw phasor diagram
3. **Name: AC RLC parallel circuit**
   Aim: To obtain current & voltage distribution in AC RLC parallel circuit
   (ii) To draw phasor diagram
4. **Name: Resonance in AC RLC series circuit**
   Aim : To obtain the condition of resonance in AC RLC series circuit
   (ii) To draw phasor diagram
5. **Name: 3 Ammeter method**
   Aim: To obtain power & power factor of single phase load using 3 Ammeter method
   (ii) To draw phasor diagram
6. **Name: 3 voltmeter method**
   Aim: To obtain power & power factor of single phase load using 3 Voltmeter method(ii) To draw phasor diagram
7. **Name: 3 phase star connection**
   Aim : To establish the relation between line & phase quantity in 3 phase star connection
   (ii) To draw phasor diagram
8. **Name: 3 phase delta connection**
   Aim : To establish the relation between line & phase quantity in 3 phase delta connection
   (ii) To draw phasor diagram
9. **Name: 3 phase power measurement**
   Aim : To measure the power input to a 3 phase induction motor using 2 wattmeter method
   (ii) To draw phasor diagram
10. **Name: Self & mutual inductance**
    Aim : To determine self & mutual inductance of coils
11. **Name: Calibration of instruments**
    Aim : To calculate percentage error of D.C. Ammeter, D.C. Voltmeter, A.C. Ammeter and A.C. Voltmeter through calibration
12. **Name : Calibration of Energy meter**
    Aim: To calculate percentage error of energy meter through calibration.

Course Outcomes:

After the completion of this course, students will be able to:

1. classify active and passive elements, explain working and use of electrical components, different types of measuring instruments;
2. illustrate fundamentals of operation of DC circuits, 1-φ and 3- φ circuits and also correlate the principles of DC, AC 1-φ and 3- φ circuits to rotating machines like Induction motor and D.C machine.;
3. measure voltage, current, power, for DC and AC circuits and also represent them in phasor notations;
4. analyse response of a circuit and calculate unknown circuit parameters;
5. recommend and justify power factor improvement method in order to save electrical energy.

Text Books:

1. Hughes Electrical Technology, Revised by McKenzie Smith, Pearson.
2. Fitzgerald and Higginbotham, Basic Electrical Engineering, McGraw Hill Inc, 1981.

Reference Books:

1. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 3rd Edition, TMH, New Delhi, 2009.
2. W. H. Hayt, Jr J. E. Kemmerly and S. M.Durbin, Engineering Circuit Analysis, 7th Edn TMH, 2010.
3. Electrical Engineering Fundamental, Vincent Del Toro, Prentice Hall, New Delhi.

Course code: EC3202
Course title: Digital Electronics Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Fundamentals of basic electronics.
Classes scheduled per week: **3 classes per week**
Course Objectives:
This course enables the students:

1. To educate the students about how to implement and verify the digital circuits learnt in theory using ICs and other related hardware.
2. To educate the students about a simulation software for implementation and verification of the digital circuits.
3. To encourage students for taking up a mini project based on digital electronics which we observe or can be beneficial for our day to day life.
4. To encourage students for carrying out optional experiments by self-learning.

List of Experiments:
Compulsory:

1. Design and realization of parity bit checker using IC 7486.
2. Design and realization of 4:2-line encoder using IC 7432.
3. Design and realization of 4-bit magnitude comparator.
4. Assembling of a 7 segment decoder using IC7447 and IC7404.
5. Design and testing of SR and JK flip flop using IC 7400, IC 7402 and IC7408.
6. Design of a 2-bit binary parallel adder using IC CD4030, IC CD4081 and IC7432.
7. Design of an astable multivibrator using IC 555 Timer and observe the output waveforms.
8. Design of a monostable multivibrator using IC 555 Timer and observe the output waveforms.
9. Design and testing of 2:1 multiplexer and CMOS switch using IC CD4066 and IC7404.
10. Design of a 4 bit serial in serial out shift register using IC CD4027.
11. Design of a modulo 9 ripple counter using IC CD4091 and IC7408.
12. Design of a schmitt trigger circuit using IC 741 Op-amp and observation of the output waveforms.

Optional:

1.
    a. Design and realization of Binary to Gray code converter using IC 7486.
    b. Design and realization of Gray to Binary code converter using IC 7486.
2. Design of an Ex-or gate using minimum number of 2input Nand gates.
3. Design of a 1-bit half subtractor using CD4066.
4. Design of a modulo 256 ripple counter using IC CD7493.
5. Design of a 4:16 line encoder using IC CD4514.
6. Reading 8 specified location of a programmed IC Intel 2716.
7. Storing a nibble in an IC 2114 RAM and read it.

Course Outcome:

On the completion of this course,

1. The students will be able design digital circuits (which find applications in real world) in gate level and IC level using hardware and software.
2. The students will be able to analyze and verify the digital circuit for correct functioning.
3. The students develop skills for working in a group. Skills like leadership, planning, individual innovative thinking, presenting, convincing and addressing queries.
4. The students understand how and where to search the basic knowledge he/she is looking, for carrying out any work related to the digital electronics assigned to them

Text Books:

1. Digital Design, M. Morris Mano. Prentice Hall India
2. Modern Digital Electronics, 3/e, R. P. Jain, TMH.

Reference Books:

1. A first course on Digital Electronics, Nigel. P. Cooper, PHI.
2. Digital Fundamentals, Floyd, Pearson.
3. Digital Computer Electronics, Malvino, Brown, TMH.

Course code: EE3212

Course title: Computing Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Fundamentals of Computer, Basic Concepts of Signals & Systems Engineering.

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. To impart students fundamental knowledge of MATLAB.
2. To make hand on practice to write MATLAB code on network fundamentals like incidence, reduced incidence, f-loop matrix etc.
3. To acquaint students with the knowledge of Laplace and inverse Laplace transform using MATLAB.
4. To make them understand the simulink modeling, state space modeling.

List of Experiments:

EXPERIMENT NO. 1

Name of the Experiment: introduction to MATLAB

Aim: introduction to MATLAB

EXPERIMENT NO. 2

Name of the Experiment: Introduction to the signals like unit step, unit ramp, and unit parabolic signal

Aim: Write the program for the signals like unit step, unit ramp, and unit parabolic signal

1.2 Write code for addition, subtraction and multiplication of the signals

1.3 Write the code for the type of signal like continuous signal, discrete signal.

EXPERIMENT NO. 3

Name of the Experiment: The preparation of a computer program to help in implement the solution of electrical network shown in fig 1.

Aim: for the Network Theory problem Prepare the program to determine a reduced- incidence matrix.

EXPERIMENT NO. 4

Name of the Experiment: The preparation of a computer program to help in implementing the solution of electrical network shown in fig 1.

Aim: for the Network Theory problem prepare the program to determine

(1) A f-loop matrix

(2) A f-cut set matrix

EXPERIMENT NO. 5

Name of the Experiment: The preparation of a computer program to help in implementing the solution of electrical network.

Aim: Prepare a program to determine the number of trees in a network with essential condensation used to evaluate the determinant. Specify the input data format.

EXPERIMENT NO. 6

Name of the Experiment: The preparation of a computer program to help in implement the solution of electrical network.

Aim: Prepare a program to determine the (a) node admittance matrix,(b) loop impedance matrix,(c) node pair admittance matrix of RLC network by evaluating the (1) node parameter matricis ,(2) loop parameter matricis,(3) node pair parameter matricis respectively.

EXPERIMENT NO. 7

Name of the Experiment: The preparation of a computer program to help in implement the solution of electrical network shown in fig 1.

Aim: Combine the program 2, 3 and 4 to create a single program that will determine at the program user's option the node admittance matrix, loop impedance matrix and/or node-pair admittance matrix of a RLC network.

EXPERIMENT NO. 8

Name of the Experiment: The preparation of a computer program to help in implement the solution of electrical network.

Aim: With help of inter-relation among various matricis write the code for converting the one form of matrix in to other two matricis as munitioned above.

EXPERIMENT NO. 9

Name of the Experiment: Finding Laplace transform of some given function.

Aim: To find Laplace transform of some given function.

EXPERIMENT NO. 10

Name of the Experiment: Finding inverse Laplace transform of some given function using convolution integral.

Aim: To find inverse Laplace transform of some given function using convolution integral.

EXPERIMENT NO. 11

Name of the Experiment: Developing SIMULINK diagram for a given system.

Aim: To develop a simulation diagram of the given system using MATLAB SIMULINK.

EXPERIMENT NO. 12

Name of the Experiment: Develop a state-space model for an electric network.

Aim: To develop a state-space model for a given electric network.

Course Outcomes:

After the completion of this course, students will be able to:

1. understand the basic concepts and commands used in MATLAB.
2. have the knowledge of the different types of signal generation and arithmetical operation.
3. understand the processes of developing and implementing MATLAB for network matrix generation and finding the loop currents, node voltage of electrical networks;
4. learn the concepts of finding Laplace transform and inverse Laplace transform of a function.
5. understand of how a Simulink model of electrical network can be developed using MATLAB.

Semester: 4

Course code: HU4003
Course title: German

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Higher secondary with knowledge of English language
Class schedule per week: 3 classes per week
Course Objectives: Developing the following language competencies:

1. LISTENING: To enable the learners to listen and understand the spoken German language which uses the elementary spoken structures.
2. SPEAKING: To enable the learners to speak and engage in simple dialogues in German.
3. READING SKILLS AND TEXTUAL COMPREHENSION: To enable the learners to read and understand the elementary texts in German.
4. WRITING**:** To enable the learners to write simple sentences and short paragraphs in German.
5. To expose the learners to the historical, social and cultural aspects of Germany and other German speaking countries.

Syllabus
Module I
Sich begrüssen, sich vorstellen, sich verabschieden und Woher kommen Sie? Ländernamen, Nationalitätsbezeichnung, Das Verb: Präsens – (sein, heissen), Personalpronomen: ich und Sie, Verb + Adjektiv, Das Nomen: Singular und Plural, Zahlen von 1 – 10. Antworten mit Ja / Nein
Module II
Das Alphabet, buchstabieren, Das Verb: haben, schliessen, machen, Fragepronomen, Zahlen von 1- 100, Personalpronomen du, er und sie und es, Das Demonstrativpronomen „das", Unterschied zwischen Uhr – Stunde, Negativartikel, Der Artikel: bestimmter und unbestimmter Artikel.
Module III
Reisende im Gespräch, Das Verb: Präsens - (fahren, lesen, nehmen usw.), Vorsilbe und Verb (trennbare Verben), Wortstellung von trennbaren Verben, Präpositionen, Tage – Monate. Erklärung von drei **sie/Sie,** Der Akkusativ, „es gibt/gibt es"**.**
Module IV
Ein Freunde besucht, über Familie sprechen, Das Nomen: Dativergänzung, Der Dativ und der Akkusativ, Das Fragepronomen: Wem?, Possessiv-Pronomen, Präpositionen mit dem Dativ und mit dem Akkusativ, Wortstellung, Das Zeitadverb.
Module V
Rat geben, Geburtstag feiern, Telefongespräch, Die Uhrzeiten, Modalverben - (wollen, müssen, können), Wortstellung bei Modalverben, Das Personalpronomen bei Akkusativ- und Dativergänzungen und deren Wortstellung.
Module VI
Die Wohnung beschreiben, Ein Zimmer vermieten, Richtungsangaben, Das Demonstrativpronomen: dies, wohen? – wo? – wohin? Präpost. mit dem Akkusativ oder Dativ, Zahlen von 100–1000, Jah, Das Verb: dürfen – sollen.
Module VII
Im Supermarkt, Konjugation von möchten, Der Genetiv, Das Präteritum: sein und haben, Reflexivp., Das Perfekt.

Course Outcomes:

After completion of the course, the learners will be able to:

1. understand familiar, everyday expressions and simple sentences.
2. introduce him/herself and others as well as ask others about themselves and communicate using simple sentences.
3. read and comprehend basic German sentences relating to routine situations.
4. write simple sentences and short paragraphs in German.
5. identify and deal with social and cultural aspects of Germany and other German speaking countries.

Text Books:

1. Heinz Griesbach, Dora Schulz. Deutschsprachlehre für Ausländer, Max Hueber Verlag, München, Germany.(Note: Text pages relevant to the modules will be only dealt with).

Reference Books:

1. Hartmut Aufderstrasse, Jutta Müller, Thomas Storz. Lagune: Kursbuch: Deutsch als Fremdsprache A1-I + II,Hueber Verlag, Ismaning, Germany.
2. Roza Maria Dallapiazza, Eduard von Jan, TilSchönherr. Tangram Aktuell – A1-I + II, Max Hueber Verlag, Ismaning, Germany.

Course code: HU4001
Course title: French

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Higher secondary with knowledge of English language
Class schedule per week: 3 classes per week
Course Objectives:

1. **Course Objective I –** *Using Language*
   Students will develop the knowledge, understanding and the listening, reading, speaking and writing skills necessary for effective interaction in French.
2. **Course Objective II** – *Making Linguistic Connections*
   Students will explore the nature of languages as systems by making comparisons between French and English, leading to an appreciation of the correct application of linguistic structures and vocabulary.
3. **Course Objective III** – *Moving Between Cultures*
   Students will develop knowledge of the culture of French-speaking communities and an understanding of the interdependence of language and culture, thereby encouraging reflection on their own cultural heritage.

Syllabus :

Module 1
Langue Française, Le pronom personnel, Articles définis et indéfinis, Verbes au présent, Se présenter et présenter quelqu'un (salutations formelles et informelles)
Module 2
Nationalités, professions, nombres, les heures, les jours de la semaine, les mois de l'année, Négation, Demander et donner des infos personnelles
Module 3
Articles partitifs, expression de la quantité, Les chiffres, Formule de politesse
Module 4
Adjectifs démonstratifs, Adjectifs qualificatifs (mas/fém., pluriel etc.) et possessifs
Utilisation de « est-ce que ? » et « qu'est-ce que c'est ? » quel, quelle etc.
Module 5
Parler de goûts et des préférences et leurs degrés, Trois formes d'interrogation, L'impératif
Module 6
Le présent, futur proche, passé récent, Décrire une personne ou un lieu, Écrire une carte postale, e-mail
Module 7
Le passe composé, le futur, Parler de ses activités quotidiennes, Décrire la ville, des amis, des parents etc.

Course Outcomes:

A learners:

(1). Listening and Responding	Recognises and responds to words, phrases and simple sentences in spoken French
(2). Reading and Responding	Identifies and responds to features of written French
(3). Speaking	Uses known words in French to interact in everyday activities
(4). Writing	Demonstrates developing writing skills by recognising and copying French Uses familiar language to share information Uses models to write text to convey personal information and ideas

(5) Making Linguistic Connections	Recognises the diversity of language systems Explores ways in which meaning is conveyed in French. Identifies ways in which meaning is conveyed by the sounds and symbols of French
(6) Moving Between Cultures	Demonstrates awareness of cultural diversity Identifies cultural practices in French-speaking communities. Recognises the link between culture and a sense of identity

Referred Books and Study Materials:

1. Jumelage - Niveau-1, Manjiri Khandekar & Roopa Luktuke, Saraswati House Pvt. Ltd. New-Delhi
2. Alter Ego-1, Annie Berthet, Catherine Hugot, Véronique M. Kizirian, Béatrix Sampsons & Monique Waendendries, Hachette, Paris
3. Campus- 1, Jacky Girardet & Jacques Pécheur, CLE international, Paris
4. Libre Echange- 1, Janine Courtillon, Geneviève-Dominique de Salins & Christine Guyot-Clément, Didier, Paris
5. Echo - A1, Jacky Girardet & Jacques Pécheur, CLE International, Paris
6. Le Nouveau sans Frontières-1, Philippe Dominique, Jacky Girardet, Michel Verdelhan & Michel Verdelhan, CLE International, Paris.
7. 450 Exercices de phonétique, Lucile Charliac, Jean Thierry, Bernard Loreil & Annie Claude, CLE International, Paris.

Course code: EE4201
Course title: Electrical Measurement and Instrumentation

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Basic knowledge of Mathematics, Basic knowledge of Natural and Engineering Physics, Basic knowledge of Electrical circuits, Basic knowledge of Laplace transform, Basic knowledge of digital electronics and communication

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. to outline the students an idea of calibration, standards, different errors, static and dynamic performance characteristics.
2. to explain the operating principle of different analog and digital instruments used for electrical parameter measurement
3. to classify and outline the operation and construction of various a.c. and d.c. bridges for measurement and display devices.
4. to state the basic principle of commonly available transducers and their uses for measuring different electrical or non-electrical variables.

Syllabus

MODULE -I

Introduction: Definition of measurement, Generalized input-output configuration of measuring instruments and instrumentationsystems.Performance characteristics (static and dynamic), Accuracy, Precision, Types of error, Statistical analysis, Standards of measurement. Systems of units. Fundamental and derived units. Dimensions.

MODULE – II

Analog Instruments: Basic requirement of a measuring instrument. Introduction to D' Arsonval galvanometer, Construction and principle of Moving coil, Moving iron, Induction types of instruments, Measurement of voltage, current and power, phase, frequency, Range extension including current and potential transformers.

MODULE – III

Bridge: DC bridges for measurement of resistance Wheatstone bridges, Kelvin's double bridges and AC bridges for measurement of L, R, C & M, Maxwell's bridges, Anderson's bridges, Wien's bridges. Measurement of frequency, localization of cable fault. Potentiometers: DC and AC potentiometers, Principles, Standardization and application.

MODULE – IV

Electronic Instruments: Electronic voltmeter, Digital voltmeter, vector voltmeter, Vector Impedance meter and Q-meter.

MODULE-V

Display Devices & Recorders: Digital display, LED, LCD, Strip chart recorder, X-Y recorder

MODULE – VI

Transducers: Classification, Inductive, Resistive and Capacitive transducers, Analog and Digital Transducers with applications. Hall effect, Piezo Electric, Photovoltaic transducer. Measurement of temperature and pressure

MODULE – VII

Oscilloscopes: CRT, Construction, Basic CRO circuits, Block diagram of a modern oscilloscope, Y-amplifiers, X-amplifiers, Triggering, Oscilloscopic measurement. Special CRO's: Dual trace, Dual beam, Sampling oscilloscope, Storage CROs.

Course Outcomes:

After the completion of this course, students will be able to:

1. Identify and analyze errors andstate the static and dynamic characteristics of instruments.
2. Explain the working of different analog instruments (PMMC,Moving iron, electrodynamometer type) and their use for measuring voltage, current, power, phase and frequency.
3. Show how to balance and design different bridge networks to find the value of unknown components.
4. State the working of digital instruments, display devices and recorders.
5. Reproduce the different working principles of transducers and also design transducers for measurement of non-electrical quantities.

Text Books:

1. Helfrick and Cooper - Modern Electronics Instrumentation and Measurement, Pearson Education, New Delhi.
2. Sawhney A.K. - Electrical & Electronic Measurement and Instrumentation, Dhanpat Rai & Son's.

Reference Books:

1. Patranabis D – Sensors and Transducers, Wheeler, 1996.
2. Kalsi - Electronics Instrumentation, TMH Publication, New Delhi.
3. Deoblin – Measurement Systems.
4. Patranabis D – Principles of Industrial Instrumentation, TMH Publication, New Delhi, 1976.
5. Golding- Electrical Measurement, Wheeler Publication.

Course code: EE4203
Course title: Electrical Machines – I

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Principle of Electrical Engineering, Electrical Energy Generation and Control.
Class schedule per week: 3 classes per week
Course Objectives:

The course objective is to provide student:

1. to explore the basic principles of transformer and dc machines and analyze comprehensively their steady –state behaviors,
2. to examine characteristic of static and dynamic dc machines
3. a technique to draw armature winding of dc machine and magnetic circuit of transformer in order to evaluate their performance,
4. to design and recommend low cost and high performance machines which finds applications in modern industries, homes and offices.

Syllabus

MODULE – I

Basic Concepts of Electrical Machines: Introduction, Electromagnetic induction, flux linkage, statistically and dynamically induced emf, Classification and description of electrical machines, Heating and cooling of electrical machines.

MODULE – II

Elements of Rotating Machines: Introduction, Basic Components, Rotor, Stator and field excitation. Generator and motor action, EMF and torque equations, Leakage flux, Losses and efficiency, Rating and loss dissipation, Electrical and mechanical degrees.

MODULE – III

Introduction to D.C. Machines: Constructional parts of d. c. machines and their function, Principle of operation, Armature winding- Lap and wave, Simplex and duplex, Method of excitation, Classification, Derivation of emf and torque equations, Process of commutation, Armature reaction, Interpoles, Compensating winding and equalizer rings.

MODULE – IV

DC Generators: Operating Characteristics- Magnetization, Internal and external characteristics, Critical resistance and critical speed, Process of building up of voltage, Causes of failure of voltage build-up and remedies, Parallel operation of d.c. generators, Applications.

MODULE – V

D.C. Motors: Basic equation for voltage, Power, Torque and speed, Condition for maximum power, Operating characteristics- Torque-current, Speed-current and Torque-speed characteristics. Comparison, Starters, Speed control methods, Testing of d.c. machines- Swinburn's, Hopkinson's and Series field tests. Calculation of efficiency, Applications.

MODULE – VI

Transformers: Principle of operation, Construction and practical considerations, Ideal and physical transformer, emf equation, transformation ratio, Phasor diagram. Performance analysis, Equivalent circuit, Losses and efficiency, Condition for maximum efficiency, Determination of equivalent circuit parameters by O.C. and S.C. tests, Per unit calculation, Polarity test, Voltage regulation, all day efficiency.

MODULE – VII

Transformer Connections and Operation: Back-to-back test, Parallel operation, Autotransformer, 3-phase transformer, Three-phase transformer connections- Star-star, Delta-delta, Star-delta, Delta-star, Zig-zag connections. Scott connection, Open delta connection, Transformer cooling.

Course Outcomes:

At the end of the course, students will be able to-

1. state and explain working principle, constructions as well as steady- state behaviour of an ac static and dc machines;
2. interpret the different transformer and dc machines;
3. identify, formulate and solve problems related to power transformer and dc machines;

4. specify, interpret data, design an electrical machine and make a judgment about the best design in all respect;
5. aspire for developing career with specialization in areas of electric machine drives, recognize the need to learn, to engage and to adapt in a world of constantly changing electric machine technology.

Text Books:

1. I. J. Nagrath, D.P. Kothari, Electric Machines, 4th Edition , TMH, New Delhi, 2014.
2. P. S. Bimbhra, Electrical Machines, Khanna Publishers, New Delhi,7th Edition 2014.

Reference Books:

1. A.E. Fitzraul, Charles Kinsley, Stephen D. Umansd ; Electric Machinery , McGraw Hill Education (India) Pvt. Ltd , Noida, Indian 6th Edition. 2003.
2. E.H. Langsdrof; Theory of Alternating Current Machinery , McGraw-Hill, New York 1955.

Course code: EE4207
Course title: Digital Signal Processing

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Fundamentals of transform methods, Signals and Systems, Filter theory.
Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students:

1. To enumerate the basic concepts of signals and systems and their interconnections in a simple and easy-to-understand manner by summarizing different mathematical operations like folding, shifting, scaling, convolutions, Z-transform etc.;
2. To determine transfer function, impulse response and comment on stability of a system; C. predict time and frequency response of discrete-time systems by applying various techniques like Z-transform, DFT and FFT.
3. To predict time and frequency response of discrete-time systems by applying various techniques like Z-transform, DFT and FFT.
4. To design digital IIR and FIR filters using filter approximation theory, frequency transformation techniques, window techniques and finally construct different realisation structures.

Syllabus
MODULE – I
Introduction: Discrete-Time Signals, Shanon's sampling theorem, Difference equation description, characteristics of digital filters and time domain analysis, properties of discrete time system (linearity, time-variance, convolution), BIBO stability, Z-transformation and their application in solving difference equations, Relationship between Laplace and Z-transforms.
MODULE – II
Frequency Domain Analysis: Discrete Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT), Periodic convolution, Direct evaluation of DFT, FFT algorithms- decimation in time and frequency, Relationship between Fourier and Z-transforms
MODULE – III
Digital Filter Structures: Direct form I&II, cascade, parallel and ladder realizations.
MODULE – IV
Filter Function Approximations and Transformations. Review of approximations of ideal analog filter response, Butterworth filter, Chebyshev Type I & II.
MODULE – V
Frequency Transformations: Frequency transformation in analog domain, frequency transformation in digital domain.
MODULE – VI
Design of IIR Filter: Design based on analog filter approximations, Impulse invariance method, Matched Z-transformation, Bilinear transformation.
MODULE – VII
Design of FIR Filters: Symmetric and antisymmetric FIR filters, design of linear phase FIR filters using windows and frequency – sampling methods, design of optimum equiripple linear phase FIR filters, comparison of FIR and IIR filters.

Course Outcomes:

After the completion of this course, students will be able to:

1. State sampling theorem and reproduce a discrete-time signal from an analog signal;
2. Classify systems based on linearity, causality, shift-variance, stability criteria and represent transfer function of the selected system;
3. Classify systems based on linearity, causality, shift-variance, stability criteria and represent transfer function of the selected system;
4. Design FIR and IIR filters used as electronic filter, digital filter, mechanical filter, distributed element filter, waveguide filter, crystal filter, optical filter, acoustic filter, etc.
5. Construct (structure) and recommend environment-friendly filter for real- time applications.

Text Books:

1. John G. Proakis, Dimitris G. Mamalakis, Digital Signal Processing, Principles, Algorithms and Applications, Third edition, Pearson International Edition.
2. Alan V. Oppenheim Ronald W. Schafer, Digital Signal Processing, PHI, India.

Reference Books:

1. Antonious, Digital Filter Design, Mc-Graw-Hill International Editions.

Course code: EE4209
Course title: Engineering Electromagnetics

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): Vector analysis, co-ordinate geometry, applied mathematics (differential equation), physics

Class schedule per week: 4 classes per week

Course Objectives:

The course objective is to provide students with an ability to:

1. understand the basic laws (including Maxwell's equations & boundary conditions) in Electrostatics and Magnetostatics;
2. interpret the characteristics of EM waves in free-space , conductors & dielectrics(with an emphasis on time-varying Maxwell's equations and boundary conditions) , with Reflection and Refraction phenomenon of EM waves at different media interfaces;
3. describe the TE & TM wave propagation in guided mediums;
4. visualize the source & structure of wave propagation(antennas & radiation).

Syllabus

MODULE – I

Electrostatic and Magnetostatic Energy, Forces and Torques: Electrostatic energy. Electrostatic forces and torques in terms of stored electrostatic energy. Magnetic energy. Magnetic forces and torques in terms of stored magnetic energy.

MODULE – II

Electrostatic Boundary-Value Problems: Introduction. Poisson's and Laplace's equations. Boundary conditions. Uniqueness theorem. Solution of one-dimensional Laplace's and Poisson's equations. Solution of two-dimensional Laplace's equation by method of separation of variables in cartesian, cylindrical and spherical coordinates.

MODULE – III

Plane Electromagnetic Waves: Wave equations. Helmholtz equations. Plane waves. Propagation of uniform plane waves in dielectric and conducting media. Polarization of plane waves.

MODULE – IV

Reflection and Refraction of Plane Waves: Electromagnetic boundary conditions. Reflection of normally and obliquely incident plane waves from perfect conductor and dielectric. Total reflection. Total transmission.

MODULE – V

Rectangular Waveguides and Cavity Resonators: Introduction. General wave behaviors along uniform guiding structures. TEM, TM and TE waves. Rectangular waveguides. Rectangular cavity resonators.

MODULE – VI

Radiation and Antennas: Introduction. Scalar and vector potentials. Retarded potentials. Radiation from elemental electric dipole. Antenna pattern and antenna parameters. Thin linear antennas. Half-wave dipole. Effective antenna length. Antenna arrays. Two-element arrays.

MODULE – VII

Solution of Two-Dimensional Problems: Method of images. Conformal transformations.

Course Outcomes:

At the end of the course, the student will be able to :

1. apply vector calculus to static electric fields & steady magnetic fields and analyze time-varying Maxwell's equation in different forms (differential and integral);
2. apply the method of images & method of separation of variables to electrostatic boundary value problems;
3. examine the wave propagation phenomena in different media and its interfaces, while associating its significance to reflection and refraction of EM waves;
4. analyze the nature of electromagnetic wave propagation in guided medium related to microwave applications;
5. examine the source of radiations : the antenna, its radiation patterns and different parameters.

Text Books:

1. Cheng, D.K., "Field and Wave Electromagnatics", Pearson Education (Singapore) Pte. Ltd., 2nd Edn., 1989.
2. Hayt, W.H., J.A. Buck, "Engineering Electromagnetics", Tata Mc Graw Hill.

Reference Books:

1. Edward C. Jordan & Keith G. Balmain, “Electro-magnetic waves & Radiating System”, PHI.
2. Deepak Sood, “Field & Wave, A Fundamental Approach”, University Science Press.
3. S. C. Matapatra, Sudipta Mahapatra, “Principles of Electromagnetics”, Tata McGraw Hill.
4. Matthew Sadiku, “Principles of Electromagnetics”, Oxford University Press.
5. A. R. Harish, M. Sachidananda, “Antennas & Wave Propagation”, Oxford University Press.

SESSIONAL / LABORATORY:

Course code: EE 4202
Course title: Measurement and Electronic Instrumentation Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Knowledge of Physics, Electrical Circuits, Measurement and Instrumentation

Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students:

1. To state the procedures of measurement of low, medium and high resistances.
2. To outline the working of display devices like CRO, recorders and plotters.
3. To explain testing on dc bridge (Wheatstone bridge) for finding fault location and ac bridge, perform experiment on Energy meter and Range extension of ammeter and voltmeter
4. To list the different types of transducers and their use in measurement of speed, force, displacement, temperature and light intensity.

List of Experiments:
Experiment No. 1
Name: Recorders and Plotters
Objective: Study of recorders and plotters like Strip chart recorders, X- Y recorders and Magnetic tape recorders.
Experiment No. 2
Name: Cathode Ray Oscilloscope (CRO)
Objective: Study of CRO and applications of CRO for measurement of voltage, current, phase and frequency for sinusoidal, square and triangular waveforms.
Experiment No. 3
Name: Wheatstone bridge
Objective: Measurement of medium range resistance using Wheatstone bridge
Experiment No. 4
Name: Kelvin Double Bridge
Objective: Measurement of low resistance by Kelvin Double Bridge method.
Experiment No. 5
Name: Loss of charge method
Objective: Measurement of high resistance using Loss of charge method.
Experiment No. 6
Name: Localization of cable fault
Objective: Determination of location of point of fault in a cable.
Experiment No. 7. (a)
Name: Linear Variable Differential Transformer (LVDT)
Objective: Measurement of linear displacement using LVDT.\
Experiment No. 7. (b)
Name: Strain Gauge
Objective: Measurement of strain by the use of strain gauge.
Experiment No. 8
Name: Breakdown voltage of transformer oil
Objective: Measurement of breakdown voltage of transformer oil
Experiment No. 9
Name: Energy meter
Objective: Calibration of single phase Energy meter

Experiment No. 10
Name: Speed Measurements using Stroboscope
Objective: Measurement of speed of a rotating element (DC motor) using stroboscope.\
Experiment No. 11
Name: Optical Transducers
Objective: Determination of characteristics of optical transducers such as Photovoltaic cell, Photoconductive cell, Photo transistor cell and Pin photodiode.
Experiment No.12
Name: Thermal transducers
Objective: Determination of characteristics of thermal transducers such as RTD (Resistance Temperature Detector), IC Temperature sensor and NTC (Negative temperature coefficient) Thermistor

Extra experiments
Name: Maxwell's Inductance - Capacitance Bridge
Objective: Measurement of coil constant using Maxwell's Inductance - Capacitance Bridge.

Name: Lloyd Fisher Square method
Objective: Measurement of iron loss of a specimen by the use of Lloyd Fisher Square method.

Name: Range Extension of ammeter and voltmeter
Objective: Extension of range of voltmeter and ammeter

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

1. Show proper use of measurements on a variety of physical quantities with accuracy.
2. Explain the basic principles of measurement and experimental methods for measuring mechanical and electrical quantities with the use of transducers
3. Reproduce his acquaintance with the use of AC and DC bridges and display devices.
4. Outline the various methods of measurement of resistances.
5. Design techniques using knowledge of measurement of electric quantities.

Text Books:

1. A Course in Electrical & Electronics Measurement and Instrumentation, A.K. Sawhney, Dhanpat Rai & Sons

Reference Books:

1. Electrical Measurements and Measuring Instruments, Rajendra Prasad, Khanna Publishers, Delhi – 6.
2. Electrical Measurement, Golding, Wheeler Publication.

Course Code: EE4204

Course Title: Electrical Machine Laboratory - I

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Fundamental of Electrical Machines (Transformer and DC), Electrical Measurement

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. To the basic fundamentals related to the principle, construction and operation of Transformer and DC Machines and to give them experimental skill.
2. To measure the performance of a transformer and DC Machines by conducting various tests and to calculate the parameters.
3. To basic skills needed to test and analyze the performance leading to design of electric machines.
4. To work in a group and evaluate the results to prepare the report.

List of Experiments:

Experiment no. 1:

Name of the Experiment: Study of Transformers

Aim: To study the construction and operational details of 1-phase, 3-phase and auto transformers.

Experiment no. 2:

Name of the Experiment: Study of D.C. Machines and Starters

Aim: To study the construction and operational details of D.C. Machines and Starters (3 points & 4 Points Starters)

Experiment no. 3:

Name of the Experiment O.C and S.C. Test of a Single Phase Transformer

Aim: To find equivalent circuit parameters

a) To find different types of losses and efficiency
b) To draw the OCC and SCC.

Experiment no. 4:

Name of the Experiment: Load test of Single Phase Transformer

Aim: a) To perform load test at unity power factor
b) To calculate the voltage regulation and efficiency

Experiment no. 5:

Name of the Experiment: Magnetization Characteristic of separately Excited D.C. Generator

Aim: To plot Magnetization curve (E Vs. I_f) for different values of speed

Experiment no. 6:

Name of the Experiment: Load test of a D.C. Series Generator

Aim: To Study how the terminal voltage of a DC series generator varies with

a) load current at constant rated speed
b) To draw the external Characteristics

Experiment no. 7:

Name of the Experiment: Load test of a D.C. Shunt Generator

Aim: Plot the following Characteristics

a) Terminal voltage vs. load current
b) Field current vs. load current
c) Internal or total Characteristics

Experiment no. 8:

Name of the Experiment Speed Control of a D.C. Shunt Motor

Aim: Plot the following Characteristics

a) Speed vs. BHP and torque Vs. BHP
b) Current and efficiency vs. BHP
c) Speed vs. torque

Experiment no. 9:

Name of the Experiment Speed Control of a D.C. Shunt Motor

Aim: Plot the following Characteristics

a) Speed vs. armature voltage (field current being constant)

b) Speed vs. field current (armature voltage being constant)

Experiment no. 10:
Name of the Experiment Swinburne's Test
Aim: To conduct Swinburne's test on D.C. Shunt machine and determine its efficiency while operating as (i) Motor and (ii) Generator

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

1. Able to recognize various types of Transformer and DC Machines, detail of name plate data of the machines and sketches the various connection diagrams involving these machines.
2. Describe the features and working principle of transformers, DC Machine and starters.
3. Able to perform experiments which are necessary to determine the parameters and the performance characteristics of the transformer and dc machines..
4. Analyze the experimental results and write the report.
5. Able to work in the field of operation, control and maintenance in a group as well as individual.

Referred Books:

1. The performance and design of DC machines by A.E. Clayton
2. Theory of AC machines by A. S. Langsdorf,
3. Laboratory experiments on electrical machines by C. K. Chanda & A. Chakraborty, Dhanpat Rai & Co., New Delhi
4. Laboratory manual for electromechanics by S. S. Murty, B.P. Singh C. S. Jha and D. P. Kothari, Wiley Eastern Ltd., Delhi.

Course code: EE4208
Course title: Digital Signal Processing Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Fundamentals of transform methods, Introduction to Signals and Systems, Filter theory, Fundamentals of MATLAB.
Class schedule per week: 3 classes per week

Course Objectives:
This course enables the students to:

1. enumerate (knowledge) the basic concepts of signals and systems and their interconnections in a simple and easy-to-understand manner by summarizing (Understanding) different mathematical operations like folding, shifting, scaling, convolutions, etc. using MATLAB.
2. sub-divide and construct different realization structures.
3. determine transfer function and predict frequency response of discrete-time systems by applying various techniques like Z-transform, DFT and FFT using MATLAB and having Knowledge of fundamentals of TMS kit, digital image filter.
4. design digital IIR and FIR filters using filter approximation theory, frequency transformation techniques, window techniques in MATLAB environment.

List of Experiments:

EXPERIMENT NO. 1
Name of the Experiment: introduction to MATLAB
Aim: introduction to MATLAB

EXPERIMENT NO. 2
Name of the Experiment: Generation and representation of different types of signal
Aim: To perform generation of different signals in MATLAB.

EXPERIMENT NO. 3
Name of the Experiment: The Z-Transform and Inverse Z-Transform.
Aim: To write a program to find z-transform of given signal.

EXPERIMENT NO. 4
Name of the Experiment: The Cross-correlation, Auto-correlation between two sequences. Also, Circular convolution between two periodic sequence.
Aim: To perform cross-correlation, auto-correlation and circular convolution of two sequence.

EXPERIMENT NO. 5
Name of the Experiment: Discrete Fourier transform and Inverse- Discrete Fourier transform
Aim: To write an MATLAB program to find discrete Fourier transform and Inverse-discrete Fourier transform.

EXPERIMENT NO. 6
Name of the Experiment: DFT by DIT-FFT and DIF-FFT method.
Aim: To perform DFT by DIT-FFT and DIF-FFT methods in MATLAB.

EXPERIMENT NO. 7
Name of the Experiment: The low pass, high-pass, band-pass and band-stop filter using Butterworth approximation**.**
Aim : To write a MATLAB program for low pass , high pass and band pass filter using butterworth approximation.

EXPERIMENT NO. 8
Name of the Experiment: Familiarization with TMS-320C6713 DSP starter Kit.
Aim : To perform a descriptive and practical study for hardware of TMS- 320C6713 DSP starter Kit.

EXPERIMENT NO. 9
Name of the Experiment: Correlation of two discrete time signal
Aim : . To write a MATLAB program to perform correlation of two discrete time signal.

EXPERIMENT NO. 10
Name of the Experiment: Linear convolution of two sequence using circular matrix method.
Aim : To write a MATLAB program to perform Linear convolution of two sequence using circular matrix method.

EXPERIMENT NO. 11

Name of the Experiment: **The Radix-2 DIT FFT algorithm.**

Aim : To perform Radix-2 DIT FFT algorithm of 8-point sequence in MATLAB.

EXPERIMENT NO. 12

Name of the Experiment: **Image Processing.**

Aim: 1.To write a program to remove Salt & paper type noise from a given image
2. To change the color of specific part of given image
3. Write a program to remove Gaussian noise from given image

Course Outcomes:

After the completion of this course, students will be able to:

1. Convert analog signal into digital signals and vice-versa, generation of different signals and basic knowledge of TMS kit.
2. Examine system response using convolution methods and interpret transfer function of the selected syste;
3. Evaluate frequency response of the systems using frequency transformation technique, DFT, DIF-FFT or DIT-FFT algorithm, window techniques and visualization using MATLAB;
4. Design FIR and IIR filters.
5. Recommend environment-friendly filter for different real- time applications such as optical filter design, acoustic filter design etc.

Text Books:

1. John G. Proakis, Dimitris G. Mamalakis, Digital Signal Processing, Principles, Algorithms and Applications, Third edition, Pearson International Edition.
2. Alan V. Oppenheim Ronald W. Schafer, Digital Signal Processing, PHI, India.

Reference Books:

1. Antonious, Digital Filter Design, Mc-Graw-Hill International Editions.

Semester: 5

Course code: EE5201
Course title: Microprocessor & Microcontroller

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Boolean Algebra, Logic gates, C-programming basics
Class schedule per week: 3 classes per week
Course Objectives:
The course objective is to provide students with an ability to :

1. enumerate the architecture and fundamentals of 8-bit microprocessors and microcontrollers;
2. interpret and articulate the 8085 instruction set for developing an ALP, estimating the machine cycles;
3. correlate different Data transfer schemes for interfacing peripherals, while emphasizing 8085 interrupt structure;
4. adapt to Memory mapped I/O or I/O mapped I/O for interfacing peripherals and memory.

Syllabus
MODULE – I
Digital computer, Computer languages, Main frame, Mini computers, Microcomputers, Architecture of 8085 microprocessor, Functions of different pins, Bus Concept.
MODULE – II
Memory organization, Memory map, Interfacing devices, Memory interfacing, Different machine cycles.
MODULE – III
Instruction set, Instruction classification, Instruction format, Addressing modes of 8085, Simple illustrative programs and flow chart, System timing diagram.
MODULE – IV
Programming techniques, Looping, Counting, Logic operations, Sorting, Counter and time delays, Stack and subroutine, Code conversion BCD to binary, Binary to BCD, Binary to ASCII and ASCII to Binary, BCD Arithmetic.
MODULE – V
Data transfer schemes, Memory mapped I/O and I/O mapping, I/O port Intel 8212 interfacing with multiplexed 7-segment LED and matrix keyboard, Intel 8255 all modes, Timer 8253/8254 Keyboard/Display Interface 8279, Control words and interfacing.
MODULE – VI
Interrupt structure of 8085, Hardware and software interrupts, EI, DI, RIM and SIM instructions, Interfacing DAC 1408 and staircase ramp and triangular wave form generation, Interfacing ADC 0801, Applications.
MODULE – VII
Introduction to microcontroller, Popular microcontroller, Applications, Architecture of 8051 microcomputer, Internal and external memories, Interrupts.

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

1. visualize the basic elements and functions of 8-bit microprocessor and microcontroller;
2. schematize 8-bit microprocessor architecture, extending to organize microcontroller concept and its peripherals;
3. schedule the operation between microprocessor and its interfacing devices;
4. defend the system timing using instruction machine cycle concept;
5. devise programming and interfacing techniques for interfacing peripherals, collaborating 8085 hardware interrupts.

Text Books:

1. Ramesh S. Gaonkar, "Microprocessor Architecture - Programming, Applications" , Penram International Publishing (India) Pvt. Ltd.
2. Raj Kamal, "Microcontrollers -Architecture, Programming, Interfacing and System Design" , Pearson Education.

Reference Books:

1. Renu Singh and B. P. Singh, "Microprocessors, Interfacing and Applications" , New Age International Publication.
2. A.P. Malvino, "Digital Computer Electronics ", TMH Publishing Company Limited, New Delhi.
3. S. K. Venkatram, "Advanced Microprocessor & Microcontroller "
4. A. P. Mathur, "Introduction to Microprocessors"

Course code: EE5203
Course title: Electrical Machines - II

Credits:	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisite(s): Introduction to Principle of Electrical Engineering and Electrical Machines-I
Class schedule per week: 3 classes per week

Course Objectives:

The course objective is to provide students:

1. the basic principles of operation of ac dynamic machines and analyze their steady –state behaviour;
2. to examine characteristics of ac rotating machines;
3. a technique to draw winding diagram and circle diagram to validate performance OF an Induction motor;
4. knowledge to design and recommend high performance machines for applications in industries, homes and offices.

Syllabus

MODULE – I

Basic Concept of A.C. Rotating Machines: Introduction to Armature winding, Integral slot and fractional slot winding, Distribution factor (Kd), Pitch factor (Kp) and winding factor (Kw). Production of rotating magnetic field, EMF and torque equations, Effect of tooth harmonics and methods of reduction.

MODULE – II

Synchronous Generator: Construction, Cylindrical rotor and salient pole rotor, Principle of operation, Excitation system, Effect of winding factor on EMF, Armature reaction, Circuit model, Phasor diagram, O.C. and S.C. tests, Short-circuit ratio, Determination of voltage regulation by synchronous impedance, MMF and zero power factor methods.

MODULE – III

Performance Characteristics of Synchronous Generator: Two reaction theory, Phasor diagram, Power-angle characteristic of synchronous generators, Synchronizing power and torque, Synchronizing methods, Parallel operation of synchronous generator, Effect of change in excitation and mechanical power input on load sharing, Operation of alternator on infinite bus bars, Slip test.

MODULE – IV

Synchronous Motor: Construction, Principle of operation, Equivalent circuit, Phasor diagram, Circuit model, Effect of change in excitation on armature current and power factor, Starting of synchronous motor, Synchronous condenser, Hunting, Applications.

MODULE – V

3-ϕ Induction Motor : Introduction, Construction, Principle of operation, Slip and rotor frequency, Comparison with transformer, Equivalent circuit model, Representation of mechanical load, No load and blocked rotor tests. Torque and power output, Losses and efficiency, Separation of losses.

MODULE – VI

Performance Characteristics of 3-phase Induction Motor: Circle Diagram, Torque-slip characteristics, Effect of rotor resistance, Starting torque and maximum torque, Starting and speed control methods, Cogging and crawling, Introduction to induction generator, Applications.

MODULE –VII

Single-phase Induction Motor: Introduction, Double revolving field theory, Crossfield theory, Torque-speed characteristic, Equivalent circuit model, Starting methods, Applications.

Course Outcomes:

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

1. state and explain working, constructions as well as steady state behaviour of ac rotating machines,
2. interpret the various rotating electric machines, its significance in daily life;
3. identify, formulate and solve problems related to electrical machines;
4. specify, interpret data, apply the techniques, skills and modern engineering tools necessary for electrical machines and select an electrical machine while making judgment about the best performance in all respect;
5. aspire a career with specialization in areas of electric machine drives; in addition recognize the need to learn, engage and adapt in a world of constantly changing electric machine technology.

Text Books:

1. I. J. Nagrath, D.P. Kothari, Electric Machines, 4th Edition , TMH, New Delhi, 2014.
2. P. S. Bimbhra, Electrical Machines, Khanna Publishers, New Delhi,7th Edition 2014.

Reference Books:

1. A.E. Fitzgerald, Charles Kinsley, Stephen D. Umansd; Electric Machinery, McGraw Hill Education (India) Pvt. Ltd, Noida, Indian 6th Edition 2003.
2. E.H. Langsdorf; Theory of Alternating Current Machinery, McGraw-Hill, New York 1955.
3. M.G. Say, "Alternating Current Machines", Pitman Publishing Ltd. 1976.

Course code: EE5205
Course title: Power Electronics

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): Basics of Machines, Basic electrical and electronics, Linear electronics, analog & integrated electronics

Class schedule per week: 4 classes per week

Course Objectives:

The course objective is to provide students with an ability to :

1. briefly describe various types of high power switches and their switching techniques;
2. explain the operating principle of power electronic converters with voltage and current waveforms and illustrate their applications in electrical technology;
3. analyze and perform evaluation of power electronics based technology;
4. plan and design procedure for a power electronics based system.

Syllabus :

MODULE – I

Scope of power electronics, Overview of high power semiconductor switches, Two transistor analogy of SCR terminal characteristics, Rating and protection of SCR, UJT and Industrial firing circuit.

MODULE – II

Dynamic characteristics of SCR, Gate characteristics, series and parallel operation of SCR, power diodes.

MODULE – III

Single phase controlled, Half wave, Full wave rectifier with R, RL and RLE loads, Single phase semiconverter, Effect of Source impedance performance, Evaluation of converter using Fourier series analysis.

MODULE – IV

Three phase controlled rectifier with resistive load, Three phase half wave, Full wave rectifiers with R-load, 3-phase semiconverter, RMS, Average value, Fourier analysis,THD, HF and PF of converter.

MODULE – V

Chopper, Introduction, Principle of operation control, Strategies, Step-up and step-down chopper, Chopper configuration, Type A,B,C,D & E chopper uses.

MODULE – VI

Single phase inverter, VSI and CSI, Analysis with R, RL, and RLC loads, 180^o and 120^o mode of operation of 3-phase VSI, SPM, MPM and Sinusoidal PWM techniques, Series inverters use.

MODULE – VII

AC voltage regulators, 1-phase ac voltage controller with R and RL loads, Integral cycle control. Cycloconverters: Introduction, The basic principle of operation, Steps up and step-down cycloconverter, Single phase to single phase cycloconverters.

Course Outcomes:

At the end of the course, the student will be able to :

1. list different types of high power semiconductor switches and interpret their operating characteristics;
2. classify and explain the working principle of various kinds of power converters, while achieving voltage regulation with the help of power converters;
3. analyze power electronic converters using fourier series technique to identify design parameters for high performance converters;
4. estimate the cost and long term impact of power based installations;
5. reorganize existing power electronics based installations and develop new power converters , while planning to design a power processing unit.

Text Books:

1. M.D. Singh, K.B. Khanchandani, Power Electronics, TMH,New Delhi 2008.
2. P.S. Bimbra, Power Electronics , Khanna Publications, 5^{th} Edition, New Delhi, 2012.

Reference Books:

1. M.H. Rashid, Power Electronics: Circuits, Device and Applications, 2^{nd} Ed.n, PHI, New Jersey, 2003.
2. Mohan, Underland, Robbins; Power Electronics Converters, Applications and Design, 3^{rd} Edn., 2003, John Wiley & Sons.
3. R.S. Ramshaw, Power Electronics Semiconductor Switches, Chapman & Hall 2^{nd} Edition, 1993, , Chennai.

Course Code: EE5207
Title of the course: Power System - I

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge of Physics, Mathematics, Principle of Electrical Engineering, Electromagnetic Theory, Basic Electronics, Electric Energy Generation.
Class schedule per week: 3 classes per week

Course Objectives:
The course objective is to provide students with an ability to :

1. conceptualize the fundamentals of Power Systems**:** its structure, analysis, operation and control;
2. understand the mathematical modeling of transmission and distribution system;
3. design transmission and distribution systems in line with enhancing transmission line efficiency and voltage regulation;
4. expose themselves to the mechanical design concepts like effective sag, string efficiency enhancement of insulator string, underground cables.

Syllabus:
MODULE – I
Introduction: Structure of a power system, Effect of transmission voltage, Different curves: load curves, Load duration curve, Different factors for Power plant operation: Demand factor, Load factor, diversity factor, plant capacity factor, plant utilisation factor, cost of electrical energy, different types of tariff: simple type, flat rate types, bulk rate, two part, three-part tariff, availability based tariff.
MODULE – II
Constants of O/H lines: Types of conductors, bundle conductor, resistance calculation, skin effect, inductance and capacitance of overhead lines: Inductance and capacitance of single phase and three phase line, Transposition, Double ckt. three phase lines.
MODULE – III
Over head line insulators: Types of insulators, potential distribution over a string of suspension insulators, methods of enhancing string efficiency, Underground cable: types, extra high voltage cables: electrostatic stresses, grading of cables.
MODULE – IV
Mechanical design of transmission line: Sag tension, length calculation, effect of wind and ice loading. corona effect.
MODULE – V
Distribution Systems: Feeders, distributors, and service mains, redial and ring main system, different types of DC and AC distribution systems, calculation.
MODULE – VI
Transmission System: Performance of transmission line, representation of short, medium and long transmission lines, Ferranti effect, SIL, Tuned Power Line, Power flow through transmission lines.
MODULE – VII
Voltage control: Dependency on reactive power, method of reactive power injection at load end.

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

1. understand the importance of the different factors like load curve, load factor, diversity factor, plant load factor for economic and effective operation of power systems;
2. determine the different parameters of overhead lines and underground cables;
3. formulate the relevant mathematical equations involved for different types of line and apply the equations for electrical design of the line in the context to voltage regulation, efficiency, corona etc.;
4. explain the core concept involving mechanical design of lines with the objective to keep effective sag, number of insulators etc.;
5. apply the understanding in designing distribution systems in the context of satisfying voltage constraint and the size of reactive power compensator for receiving proper voltage at load end.

Text Books:

1. Power System Analysis – Hadi Saadat, Tata McGraw-Hill Edition.
2. Power System Engineering – A. Chakrabarti, M. L. Soni, P. V. Gupta, U. S. Bhatnagar

Reference Books:

1. Modern Power System Analysis – D. P. Kothari, I. J. Nagrath, Tata-McGraw Hill.
2. Electric Energy Systems Theory - An Introduction – O. I. Elgerd, TMH Edition.
3. Electric Power System – C. L. Wadhwa, New Age International Publishing.
4. Principles of Power System - V.K.Mehta and Rohit Mehta, S.Chand

Breadth Papers:

Course code: MSH 1125

Course title: Organization Behaviour

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week

Course Objectives:

1. To explain the effect of Perception, Personality, Learning, and Attitude on individual behavior.
2. To explain the theories of Motivation and their appalication in designing Motivation tools.
3. To explain the complementary relation between the formal organization and the informal organization existing within them
4. To present the process and challenges in managing efficient formal and informal communication in work setting.
5. To explain the process of organizational change and development and discuss the strategies for successfully managing change.

Syllabus

Module 1:
Introduction to OB, Meaning and importance of study of OB; It's cross cultural implications

Module 2:
Behaviour and its Causes, Introduction to personality, perception, learning and attitude

Module 3:
Motivation: Importance, Theories of motivation - Maslow's Hierarchy of Needs, Alderfer's ERG, Herzberg's Two Factor Theory and Vroom's Expectancy Theory; motivational tools

Module 4:
Group Behavior and team dynamics: Formal and informal groups, conflict – types, sources, negotiation

Module 5:
Communication and Feedback, Interpersonal communication, Importance and hindrances; Introduction to TA

Module 6:
Organizational change and Development: Introduction to Organizational Change; Concept of OD, Phases of OD and OD interventions

Module 7:
Morale and Job Satisfaction: Introduction, Determinants and outcome of morale and job satisfaction

Course Outcomes:

After completion of the course, the learners will be able to:

1. Design strategies to ensure desirable behavior of employees by analyzing their Personality and shaping their Perception, Learning Experiences and Attitude at the workplace..
2. Recommend suitable strategies for motivating employees with varied roles and personal attributes
3. Function as an effective team member at the workplace
4. To communicate effectively and efficiently and to design strategies for successfully meeting the challenge of ensuring free flow of formal and informal communication in the organization.
5. Implement change in his domain so as to achieve targeted improvement in efficiency and effectiveness through the change implementation.

Referred Books:

1. Robbins, S.P. & Sanghi Organizational Behaviour (Prentice Hall India: New Delhi).
2. Luthanns, Organisational Behaviour, McGraw Hill, 11th Edition.

Course Code: MSH1131
Course Name: Principles of Management

Credits:	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives: To impart knowledge about

1. Nature, Scope and Characteristics, Universal application of Management Principles.
2. Different skills and roles played by a manager.
3. Evolution of Management Theories.
4. Planning with nature, purpose, importance, types of plan and planning.
5. Organizing with process, importance, formal and informal organization, tall & flat structure
6. and span of control.
7. Staffing function with recruitment, selection, placement, training and development, performance appraisal.
8. Directing function with style and theories of leadership, motivation and communication process.
9. Controlling function with purpose, basic elements of control and its process.

Topics Covered:
Introduction of Management, Evolution of Management Thought, Planning, Organizing, Staffing, Directing and Controlling.

Course Outcomes: Enables the student to:

1. Identify different managerial skills and roles of a manager and implementation of those skills according to prevailing situations.
2. Interpret the management principles and relate them with engineering solution.
3. Understand the principles of different researchers.
4. Ascertain the problem statement and diagnose with best alternative course of action (decision
5. making).
6. Collectively and collaboratively accomplish the organizational goals by creating and developing effective teams.
7. Outline the areas and types of training programme.
8. Evaluate the effectiveness of training programme.
9. Outline, explain, and elaborate the appraisal process clearly, the 360-degree feedback systems and the steps in conducting an appraisal interview and offering the feedback in a constructive manner and highlight major problems of performance appraisal.
10. Project the application of different leadership styles for different personality in the organization.
11. Project different parameters of motivation for the effective contribution of employees towards the organizational goals.
12. Assess the effectiveness of communication.
13. Critically analyze the detecting points and state the remedial measures to control.

Text Books:

1. L M Prasad. Principles & Practices of Management, 5th Edn, Sultan Chand & Sons, Reprint 2000.
2. T N Chhabra. Principles & Practice of Management, Dhanpat Rai & Co., Reprint 2010.
3. Stoner & Gilbert. Management, 9th Edn, Phi, 2013.
4. Koontz and O'Donnell. Management. Tata McGraw Hill, 2013.

Course code: PE5009

Course title: Industrial Organization and Management

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week

Course Objectives: To impart knowledge about

1. Legal forms of business organizations
2. Various types of organization structures-their features, advantages and drawbacks
3. Fundamentals of management - Principles
4. Budgetary aspects
5. Human resource development
6. Marketing and sales aspects
7. Various Industrial Acts – Labour Legislations

Topics covered: Business organizations, Principles of Management, Organization Structures, Budgetary Control, Human Resource Management, Marketing management, Industrial Legislations.

Course Outcomes: Enables the student to

1. Understand the fundamentals of business organizations – Types, Structures.
2. Obtain knowledge about management principles.
3. Get idea about budgetary aspects – Types of budget and their control.
4. Familiarize with human resource management and marketing management.
5. Know the provisions of industrial acts.

Text Books:

1. Industrial Organization and Management by Riggs et al.
2. Industrial Engineering and Management O P Khanna.

Reference Books:

1. Principles of Management Koonze o'Donell.

Course code: PE 5011
Course title: Project Engineering

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week

Course Objectives:

1. To understand the scope and types of projects
2. Students must learn about The Project Life Cycle and project constraints
3. The organizational structure of project management must be explained
4. Environmental considerations and social cost benefit analysis of projects to be covered
5. Cost and budgetary aspects of project need to be delivered to students
6. To understand Project scheduling tools (PERT and CPM)
7. To learn Project monitoring and computer software applications in project management

Topics Covered:

Definition and Types of Projects, Project scheduling, PERT and CPM, Project Evaluation

Course Outcomes:

The course enables the students to

1. Understand the project morphology, organizational structure and elements of project
2. Solve complex scheduling problems in project management using PERT/CPM
3. Handle real-life projects as in various organizations
4. Understand the importance environmental issues in projects
5. Prepare project report and budget planning

Text Books:

1. Project Management by Prasanna and Chandra, Tata McGraw Hill.
2. Elements of Project Management by Pete Spinner, Prentice Hall, USA.

Reference Books:

1. Production and Operation Management by Alan Muhlemann, John Oakland and Keith Lockyer, MacMillan India Ltd.
2. A course in PERT and CPM by R. C. Gupta, Dhanpat Rai Publications(P) Ltd, Delhi.
3. Industrial Engineering and Management by O. P. Khanna, Dhanpat Rai & Sons.

SESSIONAL / LABORATORY:

Course code: EE5202
Course title: Microprocessor Lab/Sessional

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Knowledge of the digital electronic circuits (Boolean Algebra, Logic gates), C-programming basics

Classes scheduled per week: 3 classes per week
Course Objectives:

The course objective is to provide students with an ability to:

1. develop an ability to write 8085 based assembly language programs;
2. interface different peripheral chips with microprocessor;
3. explain the concept of programmable hardware and its programming;
4. design the microprocessor based system for industrial applications.

Syllabus

1. REARRANGING BYTES:

16 bytes are residing in locations starting from 0C20H / 2400H. Write a program to transfer these bytes in locations starting from 0C40H / 2500H in such a way that first 8 bytes in the first block should appear at last 8 locations of the second block and the last 8 bytes in the first block at first 8 locations of the second block

2. CHECKING BITS OF A WORD:

A word is residing in location 0C40H / 2400H. Write a program to check each bit of the word starting from Ms bit and fill 16 locations starting from 0C20H / 2500H, with either 00H or FFH depending on the bit, FFH if bit is '1' and 00H if the bit is '0'. Also count the no. of 1's and 0's (count in BCD) in the word and store them respectively at 0C30H / 2420H and 0C31H / 2421H

3. FILLING UP 128 LOCATIONS:

Write a program to fill up 128 locations starting from 0C00H / 2400H with bytes in the following pattern: first 64 locations to be filled up as 00H, 11H, 22H, ------, FFH, 00H, 11H, 22H, --------- and so on and the last 64 locations to be filled up as FFH, EEH, DDH, ---------, 00H, FFH, EEH, DDH and so on

4. ADDITION OF 12 BYTES:

Write a program to add 12 bytes residing in locations starting from 0C20H / 2400H, and store the sum in location 0C30H / 2500H (result space 2 bytes)

5. SORTING IN DESCENDING ORDER:

Write a program to sort 16 bytes residing in locations starting from 0C20H / 2400H, in descending order in the same location.

6. MULTIPLICATION OF SINGLE BYTE BY SINGLE BYTE:

Write a program to multiply a single byte residing in location 0C20H / 2400H by another byte residing in location 0C21H / 2401H and store the product in 0C22H / 2402H (Product space 2 bytes)

7. ADDITION OF 18 BCD NO'S:

Write a program to add 18 BCD no's residing in locations starting from 0C20H / 2400H and store the sum in location 0C40H / 2500H (result space 2 bytes)

8. ADDITION OF TWO 10-BYTE NO'S:

Write a program to add a 10-byte no. residing in location 0C20H / 2400H with another 10-byte no. residing in location 0C30H / 2420H and store the sum in location 0C40H / 2440H (result space 11 bytes)

9. ADDITION OF TWO 20-DIGIT BCD NO'S:

Write a program to add a 20-digit BCD number residing in location 0C20H / 2400H, with another 20-digit BCD number residing in location 0C30H / 2420H and store the result at location 0C40H / 2440H (result space 21 digits)

10. BCD SUBTRACTION:

Write a program to subtract a 6-digit BCD number residing in location 0C30H / 2420H from another 6-digit BCD number residing in location 0C20H / 2400H and store the difference in location 0C40H / 2440H.

11. SORTING EVEN AND ODD PARITY BYTES:

Sixteen bytes reside in locations starting from 0C20H / 2400H. Write a program to sort them in the same locations according to parity, odd parity bytes first and then even parity bytes next. Keep the count (in BCD) of odd parity and even parity bytes at 0C30H / 2420H and 0C31H / 2421H respectively.

12. BINARY TO BCD CONVERSION:

Write a program to convert a single byte binary number residing in location 0C20H / 2400H, to the corresponding BCD number and store it in location 0C21H / 2401H and 0C22H / 2402H in packed form.

13. BCD TO BINARY CONVERSION:

Write a program to convert a BCD number residing at 0C20H / 2400H to its corresponding binary number and store it at 0C21H / 2401H.

14. GROUPING ODD, EVEN, DIVIDE BY 4 AND DIVIDE BY 16 BYTES:

Write a program to group 32 bytes residing in locations starting from 0C20H / 2400H in the following pattern: the odd bytes first, the even bytes but not divisible by 4, 8 or 16 next, the even bytes divisible by 4 but not by 8 or 16 next, the even bytes divisible by 8 and 16 last. They shall be stored in the same locations. Keep their respective counts (in BCD) at 4 locations starting from 0C40H / 2440H.

15. MULTIPLICATION OF TWO 5-BYTE BINARY NUMBERS:

Write a program to multiply a 5-byte binary number residing in location at 0C20H / 2400H by another 5-byte number residing in location at 0C30H / 2410H and store the result at 0C40H / 2440H (result space 10 bytes)

16. LOGICAL OPERATION:

A byte is residing at 0C20H / 2400H. Write a program to compute the bit S using the logical expression: $S = A_7.\mathbf{A_6} + A_5.A_4 + A_2.\mathbf{A_1}$ and store the bit 'S' as MS bit in the location 0C21H / 2401H.Note: Bold indicates complement

17. CONVERSION OF NIBBLES TO ASCII CODES:

8-bytes are residing in locations starting from 0C20H / 2400H. Write a program to fill 16 locations starting from 0C40H / 2420H with the corresponding ASCII codes of the nibbles such that in the consecutive memory locations, the first location shall be filled up by the corresponding ASCII of the lower nibble and the second location with that of the higher nibble.

18. NUMBER OF BITS IN BYTES:

A block of 16 bytes resides in locations starting from 0C20H / 2400H. Write a program to form a second block of size 16 with the no. of 1's in the corresponding byte of the first block, at locations starting from 0C30H / 2420H. (For e.g. the first entry in the second block will be the no. of 1's in the first entry of the first block.)

19. MAXIMUM AND MINIMUM BYTES:

A table of data is stored in the memory locations starting from 0C21H / 2401H and the no. of elements in the table (in BCD) is given at 0C20H / 2400H.Write a program to detect the maximum and minimum data byte in the table and store them at 0C10H / 2500H and 0C11H / 2501H respectively. Also store the addresses of the maximum and minimum bytes at 0C12H / 2502H and 0C13H / 2503H and at 0C14H / 2504H and 0C15H / 2505H respectively. If the maximum and minimum bytes are not unique fill 0C12H / 2502H and 0C13H / 2503H and 0C14H / 2504H and 0C15H / 2505H with 00H

20. 5-BYTE × 5-BYTE BINARY MULTIPLICATION:

Write a program to multiply a 5-byte signed binary number residing in location 0C20H / 2400H by another 5-byte signed binary number residing in location 0C30H / 2410H and store the product in location 0C40H / 2420H (result space 10 bytes)

21. BCD MULTIPLICATION:

Write a program to multiply a 6-digit BCD number residing in location 0C20H / 2400H by another 6-digit BCD number residing in location 0C30H / 2410H and store the result in location 0C40H / 2420H (result space 12 digits)

22. BINARY DIVISION:

Write a program to divide a word residing in location 0C20H /2400H by a byte residing in location 0C30H / 2402H and store the quotient in 0C31H / 2403H (result space 2 bytes) and remainder in location 0C32H / 2405H.

23. SORTING SIGNED BYTES:

Write a program to sort 16 signed binary bytes residing in location 0C20H /2400H in the same locations in such a way that the positive numbers should appear first, then zero bytes and then the negative numbers. Count the numbers of positive, zero and negative bytes and store the counts (in BCD) 3 locations starting from 0C30H / 2410H respectively

24. SORTING SIGNED BINARY BYTES IN ASCENDING ORDER:

Write a program to sort 16-signed binary bytes residing at location starting from 0C20H / 2400H in the ascending order and store them at the same locations.

25. SIZE OF A BLOCK ENDING WITH A SPECIFIED BYTE:

Write a program to estimate the size of a block which starts at 0C21H / 2401H and ends up with a data specified at 0C20H / 2400H. Keep the count (in BCD) at 0C90H / 2490H. The specified byte is also a part of the block. If the specified byte is not encountered within 99 numbers, put EEH at 0C90H / 2490H.

26. SIZE OF A BLOCK STARTING WITH 00H AND ENDING WITH 60H:

A block of memory between 0C00H / 2400H and 0CA0H / 24A0H starts with 00H and ends with 60H. Write a program to count the number of bytes in the block. The two bytes 00H and 60H should not be included in the count. The count (in BCD) should be kept at 0CA1H / 24A1H. If the count is more than 99, store EEH at 0CA1H /24A1H.

27. SIZE OF A BLOCK ENDING WITH THREE ALTERNATE 00H:
A block starts at 0C00H / 2400H and ends where three 00H at alternate locations (alternate means a 00H followed by a non-zero byte, again a 00H and again a non-zero byte and so on) are found. Write a program to estimate the size of the block including the three 00H. Keep the count(in BCD) at location 0CA1H / 24A1H. If the count is more than 99, store EEH at 0CA1H /24A1H

28. NUMBER OF TIMES FFH OCCURS AS PAIR:
A block starts at 0C20H / 2400H and ends at 0C2FH / 240FH. Write a program to count the number of times FFH occur as memory pairs and keep the count (BCD) in location 0C30H / 2410H. If four consecutive locations are filled up with FFH the count shall be 2 and so on.

29. CONSECUTIVE MEMORY LOCATIONS WITH IDENTICAL DATA:

A block starts at 0C20H / 2400H and ends at 0C3FH / 241FH. Write a program to determine the number of consecutive locations with identical data and store the count (in BCD) in location 0C40H /2420H. If three consecutive locations have identical data, the count shall be 2 and so on.

30. COUNT OF SPECIFIED BYTES:

A block of memory starting at 0C20H / 2400H has got 32 bytes. Write a program to determine the number of times 00H, 01H, 02H, FEH and FFH occur in it. The counts (in BCD) are to be stored at locations starting from 0C40H / 2420H. Keep the count of any other bytes other than the above-specified bytes, together at last.

31. FORMATION OF A THIRD BLOCK:

Two blocks of 10 bytes each are residing in locations 0C20H / 2400H and 0C30H / 2410H respectively, Write a program to form a third block of 10 bytes at locations starting from 0C40H / 2420H, such that each entry in that block is the one's complement of the larger of the corresponding entries of the first two blocks (the n^{th} entry in the third block shall be the one's complement of the larger of the n^{th} entry of the first block and the n^{th} entry of the second block)

32. ADDRESS OF LAST NON-BLANK CHARACTER:

An ASCII string exists in locations starting from 0C20H / 2400H and ends with a carriage return 0DH. Write a program to store the address of the last non-blank character at 0C10H / 2500H and 0C11H / 2501H. Also at 0C12H / 2502H store the index (in BCD) of the last non-blank character. If you do not find character in the string fill the location 0C10H / 2500H, 0C11H / 2501H and 0C12H / 2502H with 00H. Assume the length of the string is less than 99

33. REPLACING TRAILING ZEROS WITH BLANKS:

An ASCII string starts in location 0C21H / 2401H. The number of characters in the string is given in 0C20H / 2400H (in BCD). Write a program to edit the string by replacing all trailing zeros by blanks (ASCII for blank is 20H and zero is 30H)

34. ADDING EVEN PARITY TO ASCII CHARACTERS:

An ASCII string exists in locations 0C21H / 2401H. The number of characters in the string is given in 0C20H / 2400H (in BCD). Write a program to edit the string by adding even parity bit (at MS bytes) to the bytes having odd parity. Keep the count (in BCD) of the edited bytes at 0C1FH / 2500H.

35. COMPARISON OF TWO ASCII STRINGS:

Two ASCII string starts at locations 0C21H / 2401H and 0C41H / 2501H respectively. The alphabets in the first string are in capital whereas those in the second string are in small. The numbers of Characters (in BCD) are given at 0C20H / 2400H and 0C40H / 2500H. Write a program to compare the two strings. If there is one-to-one correspondence between the two strings fill the location0C60H / 2600H with FFH, otherwise with 00H

36. ASCII TO HEXADECIMAL CONVERSION:

10 bytes are residing in locations starting from 0C20H / 2400H. Write a program to check whether each of them is an ASCII representation of characters 0H to FH. If so replace them by their corresponding hexadecimal character at the same location, otherwise fill the corresponding location with an error code 00H.

37. AN ASCII STRING TO BYTE CONVERSION:

An ASCII string of characters either with ASCII '0' or ASCII '1' or few characters other than ASCII '0' or ASCII '1' exists in locations starting from 0C20H / 2400H and with a carriage return 0DH. Write a program to convert it to a corresponding byte. Disregard the invalid characters and take first eight valid characters. The first valid characters encountered should be treated as MS bit. If the string, which ends with a carriage, return 0DH does not contain eight valid characters fill all the remaining bits with 0s and form the byte. Store the byte in location 0C50H / 2500H.

38. INSERTION TO A LIST:

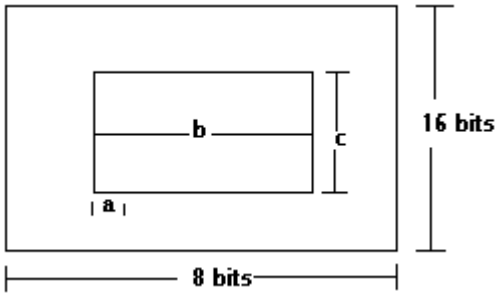
Write a program to insert the content at the location 0C20H / 2400H to a list which begins at 0C22H / 2402H, if not already present in the list and only if byte at location 0C20H / 2400H is divisible by two. The number of bytes in the list is given at location 0C21H / 2401H (in BCD). If the insertion is valid, insert the byte at the end of the list and modify the count accordingly.

39. MAPPING A RECTANGLE:

16 x 8 bytes starting from 0C20H / 2400H are considered to be map as rectangle. The starting address of the left and bottom corner is given in 0CB0H / 2500H and 0CB1H / 2501H. The number of bits, which are '1's in that location

a. is given in 0CB2H / 2502H. The number of bits to be the width
b. is given in 0CB3H / 2503H. The number of bits to be the length
c. is given in 0CB4H / 2504H. The number of bits to be the height

Write a program to map a rectangle of the above dimensions in the base rectangle with all high bits ('1's) inside the mapped rectangle. (Refer to the following figure).



Application program related with 8085 PPI

1. Write an assembly language program for generation of square wave using SOD pin of 8085.
2. Write an assembly language program for inputting an 8-bit data serially through SID pin of 8085.
3. Write an assembly language program for generation of square wave using 8255.
4. Write an assembly language program for inputting an 8-bit data through port A of 8255 in mode 0.
5. Write an assembly language program for inputting an 8-bit data through port Aof 8255 in mode – 1 through status check.

6. Write an assembly language program for display of message “HELP US” through 8279.

7. Write an assembly language program for generation of square wave using 8253.

8. Write an assembly language program to generate triangular wave using DAC 0808.

9. Write an assembly language program to generate saw tooth wave of magnitude 0 volt to +4 volts using DAC 0808.

10. Write an assembly language program to convert analog signals of magnitude +3.5 volts to +5 volts in steps of 0.1 volts to digital equivalent HEX values.

11. Write an assembly language program to calculate the conversion time of ADC using 8253 timer.

12. Write an assembly language program to observe waveforms of 8253 timer in different modes.

13. Write an assembly language program to control the speed of stepper motor using 8255 PPI.

14. Write an assembly language program to control the traffic lights using 8255 PPI.

15. Write an assembly language program to transfer data in DMA read mode using 8257 DMA Controller card.

16. Write an assembly language program to transfer data in DMA write mode using 8257 DMA Controller card.

17. Write an assembly language program for Burst Mode of operation of 8257 DMA controller.

18. Write an assembly language program to display “HELP” using 8259 PIC.

19. Introduction to micro-controller programming.

20. Interfacing of input and output devices with micro-controller.

Course Outcomes:

At the end of the course, the student will be able to:

1. demonstrate an understanding about the programming architecture of 8085;
2. apply the knowledge of assembly language programming for writing programs;
3. analyze the output waveforms of different peripheral chips;
4. design microprocessor based system for industrial purposes;
5. analyze the timing concepts between microprocessor and interfaced peripherals.

Text Books:

1. Microprocessor architecture, programming, and applications with the 8085, Ramesh S Gaonkar, Penram International Publishing (India) private limited, 5th Edition.

Reference Books:

1. Fundamentals of Microprocessor & Microcontroller, B. Ram, Dhanpat Rai Publications.

Course Code: EE 5204

Course Title: Electrical Machine Laboratory - II

Credit:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Fundamental of Electrical Machines (Transformer, DC, AC and Synchronous), Electrical Measurement

Classes scheduled per week: 3 classes per week

Course Objectives:

This course enables the students to:

1. conceptualize the principle, construction and operation of Transformer, DC Machines, Induction Motor and Synchronous Machine and enhance their experimental skill;
2. measure the performance of a transformer, Induction Motor, synchronous machine and DC Machines by conducting various tests and to calculate the parameters;
3. develop basic skills needed to test and analyze the performance leading to design of electric machines;
4. work in a group and evaluate the results to prepare the report.

List of the Experiments:

1. **Experiment No. : 01**
   Name : Study of A.C. Machines and Starters
   Object : To study the construction and operational details of 1 – phase and 3- phase A.C. rotating Machines and Starters.
2. **Experiment No. : 02**
   Name : Field's test
   Object: Determine the efficiency of DC series generator and motor for 50% and 100% of full load.
3. **Experiment No. : 03**
   Name : Hopkinson's test
   Object: Determine the efficiency of shunt generator and motor for 50% and 100% of full load generator current.
4. **Experiment No. : 04**
   Name : Ward-Leonard method of speed control
   Object : Draw the following curves:
   a) Armature voltage versus speed characteristics for 75% and 100% of rated field current
   b) Field current versus speed characteristics for 75% and 100% of rated armature voltage.
5. **Experiment No. : 05**
   Name : Scott connection
   Object :
   a) Connect two single-phase transformers for converting 3-phase to 2-phase supply.
   b) Determine the 3-phase current for different values of 2-phase (i) balanced load, (ii) unbalanced load, and draw the corresponding phasor diagram.
6. **Experiment No. : 06**
   Name : Parallel operation of a 1 – phase transformer
   Object :
   a) To test the polarity and transformation ratio
   b) Load sharing of the transformers
7. **Experiment No. : 07**
   Name : No-load and blocked-rotor test on 3-phase induction motor
   Object :
   a) Determine equivalent circuit parameters (Draw equivalent circuit and mention the values of parameters)
   b) Draw circle diagram and calculate power factor, efficiency and slip at full load
   c) Draw performance characteristics
8. **Experiment No. : 08**
   Name: Voltage regulation of a single phase alternator by direct loading and synchronous impedance method.
   Object :

a) Plot
   i) the O.C. characteristic
   ii) the S.C. characteristic
   iii) the synchronous impedance versus exciting current
   iv) the percent regulation versus percent full load curve for 0.8 p.f. lag and unity p.f.

b) Plot percent voltage regulation versus load current curve by direct loading

9. Experiment No. : 09

Name : V-curves of a 3-phase synchronous motor

Object :

a) Draw the armature current vs field current for (i) no load, (ii) half load, and (iii) full load.

b) On the above curve draw the unity p.f. line.

10. Experiment No. : 10

Name : O.C. and S.C. test on a single-phase induction motor

Object :

a) Study:
   i) The induction motor does not develop starting torque without auxiliary winding.
   ii) The starting torque is developed by connecting capacitor either in main or auxiliary winding; note the direction of rotation in each case.

b) Draw equivalent circuit and mention the values of parameters.

Additional Experiments:

11. Experiment No. : 11

Name: Load test on a D.C. compound Generator.

Object: Draw the external characteristic (terminal voltage vs. load current) for the following

1. Shunt Generator
2. Differentially Compounded Generator
3. Cumulatively Compounded Generator

12. Experiment No. : 12

Name: Slip Test of a synchronous machine

Object: To determine X_d and X_q of a synchronous machine and draw the phasor diagram for 0.8 p.f lagging.

Course Outcomes:

Upon completion of this course, the student will be able to :

1. recognize various types of Transformer, DC, Induction & Synchronous Machine, details of name plate data of the machines and sketches the various connection diagrams involving these machines
2. describe the features and working principle of transformers, Induction Machine, DC Machine and Synchronous Machine and various starters;
3. perform experiments which are necessary to determine the parameters and the performance characteristics of ac and dc machines;
4. analyze the experimental results and write the report;
5. work in the field of operation, control and maintenance in a group as well as individual.

Text Books:

1. The performance and design of DC machines by A.E. Clayton.
2. Theory of AC machines by A. S. Langsdorf.

Reference Books:

1. Laboratory experiments on electrical machines by C. K. Chanda & A. Chakraborty, Dhanpat Rai & Co., New Delhi 1997
2. Laboratory manual for electromechanics by S. S. Murty, B.P. Singh C. S. Jha and D. P. Kothari, Wiley Eastern Ltd., Delhi, 1982.

Course code: EE5206
Course title: Power Electronics Lab
Credits:

L	T	P	C
0	0	3	2

Pre-requisite(s): Basics of Machines, Basic electrical and electronics, Linear electronics, analog & integrated electronics

Class schedule per week: 3 classes per week

Course Objectives:

The course objective is to provide students with an ability to :

1. identify semiconductor switches and carryout experimentation to reproduce the I-V characteristics;
2. explain the operation of triggering circuits, commutation circuits for the semiconductor switches and different energy conversion topologies through experimentation;
3. demonstrate and draw the waveforms of the circuit variables through and across the switches and load in different energy conversion topologies, though experimentation;
4. calculate the performance parameters of energy conversion topologies through experimental and analytical approach. Design assigned circuit topology for given specification and fabricate the circuitry of any of the power converter.

List of Experiments :

1. Name: Do an experiment on Power MOSFET in order to draw its Transfer and Output characteristics.
Aim: (i) To obtain saturation, cut off and active region of a Power Mosfet.
(ii) To measure minimum gate voltage required for turning on Power MOSFET

2. Name: Study and observe different methods of commutation
Aim: (i) To observe load voltage waveform under natural commutation.
(ii) To observe load voltage waveform under forced commutation.

3. Name: A an experiment on synchronized UJT firing circuit in order to generate a pulse to fire an SCR and draw the various voltage waveforms at different stages of firing circuit.
Aim: (i) To find out valley point in UJT
(ii) To find minimum gate turn on delay time of SCR.

4. Name: In order to find Voltage Harmonic Factor (VHF), do an experiment on TRAIC based voltage regulator and draw its various waveforms, also find the range of firing angles.
Aim : (i) To obtain the RMS load voltage for TRAIC based control of AC voltage
(ii) To identify various working modes of a TRAIC

5. Name: To execute an experiment in order to find the ripple factor of a single phase bridge diode rectifier.
Aim: (i) To find relative error between theoretical calculation and practical observation of rectifier load voltage.
(ii) To calculate the value of a capacitor to reduce the ripple factor by a given percentage.

6. Name: To execute an experiment in order to find the performance measures of a single phase fully controlled thyristor rectifier with LCfilter and resistive load.
Aim: (i) Obtain relationship between firing angle and average output voltage of fully controlled rectifier
(ii) Calculation of filter parameters for reducing ripple factors.
(iii) Calculation of Transformer Utilization Factor (TUF).

7. Name: In order to find the performance do test on Power MOSFET based step down chopper with R and RL load for different duty cycle and frequency.
Aim : (i) To find relative error between calculated and observed output load voltage of Step Down Chopper with change in duty cycle.
(ii) To observe the effect of free wheeling diode.

8. Name: PSIM draw and simulate the performance of a three phase bridge rectifier with continuous current mode and different load.

Aim : (i) Introduction to simulation using PSIM
(ii) Calculation of average output voltage and ripple factor using PSIM
Aim : To study construction, working principle of different electrical machines

9. Name: Hardware based project in group.
Aim : (i) Design of a power converter based on basic knowledge of power electronics
(ii) Development of skills to function effectively as individual as well as a team member or as leader of team.
(iii) Application of interdisciplinary skills.
(iv) To think innovative ideas for possible engineering based solution for various social problems.

Course Outcomes:

After the completion of this course students will be able to:

1. identify different types of semiconductor based switching devices available in market;
2. observe different characteristics of semiconductor based switching devices;
3. choose a suitable and proper switching device for a required power electronics based design;
4. experiment with conventional power converters;
5. design simple and efficient power converters under laboratory conditions. Support a team as team member or play the role of team leader to implement projects in group.

Text Books:

1. M.H. Rashid, Power Electronics: Circuits, Device and Applications, 2nd Ed.n, PHI, New Jersey, 1993.
2. M.D. Singh, K.B. Khanchandani, Power Electronics, TMH, Delhi 2001.

Reference Books:

1. S.N.Singh, A Text Book of Power Electronics, Dhanpat Rai & Co., New Delhi 1st Edn., 2000.
2. Mohan, Underland, Robbins; Power Electronics Converters, Applications and Design, 3rd Edn., 2003, John Wiley & Sons Pte. Ltd.
3. R.S. Ramshaw, Power Electronics Semiconductor Switches, 2nd Edition, 1993, Chapman & Hall, Chennai.
4. V.R. Murhty, Power Electronics, Oxford Publishers.

Semester: 6

Course code: EE6201
Course title: Control Theory

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite: Introduction to System Theory
Class schedule per week: 3 classes per week
Course Objectives:

1. To state basic concepts of control systems and various methods to represent a system.
2. To illustrate and interpret a control system using time and frequency domain.
3. Examine techniques and analyze stability of control systems.
4. Summarize and design compensators for control systems.

Syllabus

MODULE – I

Introduction: Examples of control systems and applications, Basic components of control systems, Open loop and closed loop control systems, Effect of feedback on overall gain, Stability and external disturbances, Classification of control system : Linear and nonlinear continuous and digital, Time invariant and time varying, Minimum phase and non-minimum phase systems etc. Linearization of nonlinear systems using Taylors series.

MODULE – II

Block Diagrams and Signal Flow Graph: Block diagrams of control systems, Block diagram reduction, Signal Flow Graph (SFG)- Basic properties of SFG, SFG algebra, Gain formula to SGP, Application of gain formula to block diagrams.

MODULE – III

Time Response of Control Systems: Transient and steady state response, Time response specifications, typical test signals, Steady state error, and error constant, Stability- Absolute, Relative and conditional stability, Dominant poles of transfer function. Root Locus Methods: Root locus concept, Properties and construction of root locus, Determination of relative stability from root locus, Root sensitivity to parameter variation, Root contours, Systems with transportation lag and effect of adding poles or zeros.

MODULE – IV

Bode Analysis and Introduction to Design: Frequency response specifications, Correlation between time and frequency domain Bode plot, Determination of stability using Bode plot, introduction to design, lead, lag & lead-lag compensation.

MODULE – V

Other Frequency Domain Tools: Nyquist stability criterion, Theory of Magnitude phase plot, Constant M, constant N circle and Nichols chart.

MODULE – VI

Control System Components and Basic Control Actions: Sensors and encoders in control system, Potentiometer, Tachometers, incremental encoders, Synchros, Operational Amplifiers, Basic control actions: on-off control, P, PI, PD and PID.

MODULE – VII

Concepts of State, State Variables: Development of state-space models. State and state equations, State equations from transfer function Transfer function from state equations, State transition matrix.

Course Outcomes:

At the end of the course, a student will be able to:

1. Identify a closed loop system and represent system in terms of block diagram, signal flow graph and state diagrams and equation.
2. To describe performance of system in time and frequency domain.
3. Solve problem and analyze stability using plot in time and frequency domain.
4. To evaluate and judge different controllers
5. To design compensator for the control system.

Text Books:

1. I J Nagrath and Gopal, Control System Engineering, New Age International Publication.
2. K Ogata, Modern Control Engineering, Pearson Education.

Reference Books:

1. Norman Nise, Control System Engineering, Willey Publications.
2. Graham C Goodwin, Control System design, PHI.
3. B C Kuo, Automatic Control System, PHI.

Course code: EE6203
Course title: Power System-II

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge of basic principles of power system
Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students to :

1. describe power system by one line, impedance and reactance diagrams;
2. explain steady state operation of large-scale power systems and analyze power flow problems using numerical methods;
3. analyze power systems under fault conditions and evaluate different consequences (technical, societal, environmental);
4. analyze and formulate the dynamics of power systems for small and large disturbances and to identify the methods for enhancing the power system stability.

Syllabus
MODULE – I
Per unit system representation, Reactance diagram, impedance diagram.
MODULE – II
Load flow Analysis: Load flow problem, Y_{bus}, Formulation of problem, Solution technique using Gauss- Siedel method.
MODULE – III
Symmetrical Short Circuits Analysis: Short circuit of a Synchronous machine on no load, Short circuit of loaded synchronous machine, Thevenin's equivalent circuit approach for short circuit analysis.
MODULE – IV
Symmetrical Components: Transformation, Phase shift in star-delta transformer, Sequence impedance and sequence networks of transmission line, Synchronous machine, Transformer and power system.
MODULE – V
Unsymmetrical Short Circuits: Symmetrical component analysis of unsymmetrical short circuits, Single line to ground fault, Double line to ground fault and line to line fault.
MODULE – VI
Power system stability problem, Swing equation, System response to small disturbances, Power angle equation and diagram
MODULE – VII
Transient stability, Equal area criterion, Measures for improving transient stability.

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

1. outline different methods for representation of power system and explain with suitable examples;
2. apply different methodologies to solve different load flow problems and evaluate their efficacies;
3. analyze different type of faults occurring in a power system and evaluate their consequences;
4. solve different types of power system stability problems and recommend commensurate remedial measures;
5. analyze, evaluate and design a planning strategy for secure and stable power system.

Text Books:

1. Electric Energy Systems Theory - an Introduction by Olle I. Elgerd; McGraw Hill Education.
2. Elements of Power System Analysis by W.L.Stevenson; McGraw Hill Education.

Reference Books:

1. Modern Power System Analysis by Nagrath – Kothari, McGraw Hill Education, New-Delhi, 2003.
2. Electrical Power Systems by C. L. Wadhwa, New Age International, 2005 .
3. Power System Analysis and Design by B. R. Gupta, S. Chand Limited, 2008.

Course code: EE6205
Course title: Industrial Drives and Control

Credits:	**L**	**T**	**P**	**C**
	3	1	0	4

Pre-requisite(s): Principles of Electrical Engineering, Electrical Machines, Power Electronics
Class schedule per week: 4 classes per week
Course Objectives:

This course enables the students to:

1. explain the components of an electric drive system and understand their functions;
2. describe the dynamics of an electromechanical system;
3. choose an appropriate electric drive as per the application and requirements;
4. select a proper size of the motor as per the load requirements and develop the closed loop control and asses the performance of the drive in terms of stability, capabilities of regeneration and flexibility in control.

Syllabus

MODULE – I
Electrical Drives: An Introduction, Parts of Electrical Drives; ac and dc Drives, fundamental torque equations, Speed torque conventions and multi-quadrant operation; calculation of equivalent drive parameters, Different load torques and their nature; steady state stability; load equalization.
MODULE – II
Selection of Motor rating and its control: Introduction, thermal model of a motor, Classes of Motor Duty cycle, selection of motor and its rating, Closed-loop and open loop control of drives, Modes of Operation; speed control & Drive classifications; closed - loop control of Drives; speed and current sensing; manual, semi-automatic & automatic control.
MODULE – III
D.C. Motor Drives: Introduction, Performance characteristics of DC Motors & their Modifications; Starting of DC motors & their Design, Electric Braking; Speed Control of DC motor; Converter controlled DC Drives; Single phase converter drives, three phase converter drives, Dual converter drives, Chopper controlled dc drives, Closed loop control of dc motor, selection of components and their specifications for Dc drives.
MODULE – IV
Phase Controlled Induction Motor Drives: Introduction, Speed-torque characteristics, Starting & Braking of IM; effects of unbalancing and harmonics on IM, Speed Control techniques, Stator voltage control, Closed Loop schemes for phase controlled IM drives, Rotor resistance control, Slip speed control, Slip power recovery schemes.
MODULE – V
Frequency Controlled Induction Motor Drives: Scalar control, Variable frequency control, constant volts/Hz control, Voltage source inverter (VSI) control using PWM techniques, Closed Loop speed control of VSI drives, Control from a current source Inverter(CSI), Closed Loop speed control of CSI drives, Comparison of CSI and VSI drives. Selection of components and their specification for AC drives.
MODULE – VI
Synchronous Motor Drives: Starting, Pull-in and Braking with Fixed Frequency Supply; Variable Speed Drives, Cyclo-converter based Synchronous motor control, control of Trapezoidal PMAC motor, Close loop speed control of Synchronous Machines.

MODULE – VII
Traction System: Introduction, Requirements of ideal Traction system, supply system for electric traction, Mechanism of train movement, Tractive efforts, energy consumption. Co-efficient of adhesion, traction motors starting, braking of Traction motors. Converter controlled drives for Traction Motor, Chopper controlled DC traction drives. Voltage source inverter (VSI) controlled AC traction drives, Load commutated inverter fed synchronous motor drivers for traction, Diesel electric traction drives.

Course Outcomes:

After the completion of this course, students will be able to:

1. define an electric drive system and its component and determine the load parameters such as equivalent moment of inertia and load torque;
2. develop dynamic model of an electric drive and carry out stability analysis and explain the necessity and different types of load equalization;
3. use the information of different class of duty and thermal model to choose appropriate size of a motor for

a given application;

4. define the speed torque characteristics, different zone of operation, starting and braking of a dc-motor and ac-motor (viz. induction motor, squirrel cage induction motor, and synchronous motor) and develop the close loop control of a dc-motor/ac-motor drive and understand the mechanism of train movement and develop a controller for traction motor so that he/she can apply theoretical knowledge into practical system;
5. aspire a carrier with specialization in field of electric drive more and recognize the need to learn engage and adopt in the world of constantly changing electric drive technology.

Text Books:

1. G.K. Dubey, Fundamentals of Electrical Drives, Narosa publication, New Delhi.
2. R. Krishnan, Electric Motor Drives-modeling, analysis and control.

Reference Books:

1. S.K.Bhattacharya & Brijinder Singh, Control of Electrical Machines.
2. Mukhtar Ahmad, Industrial Drives and Control.
3. S.K.Pillai, A first course on Electrical Drives.
4. M. Chilikin, Electric Drives.
5. C. L. Wadhwa, Genaration Distribution and Utilization of Electrical energy.

Breadth papers:

Course code: MSH1117
Course title: Financial Management

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge of basic principles of Accountings.
Class schedule per week: 3 classes per week
Course Objectives: It expected to teach following concepts to the students

1. To identify basics of the financial environment.
2. To explain how to tackle common financial problems in practice
3. To analyze the financial statements of a company
4. To prepare financial statements.

Syllabus:

Module – I
Basics of Corporate Finance
Forms of business, Concept of company (Overview of Economic-Industry-Company; Fundamental Analysis), Concept of Authorized capital and types of capital as a source of Finance.
Module – II
Generation of Financial Statement
Concept of static statement (Income statement and balance sheet), Approach towards formation of these statement via basic Accounting concepts, convention with golden rules.
Module – III:
Financial Decision Making
Concepts of various reports for decision making: - Overview of Dynamic statement; fund positions and cash position of company, overview of important profitability, financial and liquidity ratio which helps in Managerial decision making.
Module – IV
Financial Management an Overview
Concept and evolution of Finance, Finance Functions; Investment decision, financing decision and liquidity decision.
Module – V
Relationship of Financial Management and Financial Accounting
Financial Management relationship with financial statements generated through Financial Accounting. Concept and relation of Items in Income statement and Balance sheet with Finance Functions.
Module – VI Overview of tax
Indirect tax and modalities required handling such taxes: - Concepts of Excise duty, Custom duties, Sales tax, Octroi and VAT.
Module – VII Contemporary Issues in Finance
Concepts of EVA, stakeholder's vs. shareholders, Activity based Budgeting, Corporate value analysis.

Course Outcomes: After completion of the course, the learners will be able to:

1. Familiarized with the various sources of finance which a business house can mobilize.
2. Analyze the Financial Statements through various tools like ratio analysis, fund flow and cash flow etc.
3. Prepare the master budget and budgets for different department
4. Implement investment decisions, the process and methods of evaluation of various investment proposals.
5. Develop the skills to analyze the impact of various financing alternatives on the wealth maximization/ valuation of the firm.

Text Books:

1. Financial Management by I.M Pandey- (Vikas Publications)
2. An Introduction to Financial Accounting by SN Maheshwari- Vikas Publications
3. Security Analysis and Portfolio Management by S Kevin – Prentice Hall India

Reference Books:

1. Corporate Finance by Ross and Taylor – (TMH Pubications)
2. Corporate Taxation

Course code: MSH 1137
Course title: Economics

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week

Course Objectives:

1. To understand the basics of economics, nature of economic system and consumers' behavior.
2. To explain demand of consumers and the cost concepts and also to make relation between cost and production.
3. To analyze different types of market, the practical market for decision taking and pricing decisions.
4. To familiarize some macroeconomic concepts for decision making like national income, money in circulation and effect of inflation on business.

Syllabus:

Module 1:

Introduction to Economics: Concept, Meaning and Subject matters of Economics.

Module 2:

Division of Economics: Basic concept of Micro and Macro Economics, Utility concept.

Module 3:

Demand analysis: Concept, determining factors and law of demand, demand schedule and demand curve, shift of demand curve and movement along the demand curve.

Module 4:

Cost concept: Different types of cost, cost curves, cost-output in short term and long term.

Module 5:

Market: Concept of Market forms according to competition-Perfect, Imperfect and Monopoly, price determination under Perfect competition.

Module 6:

National Income: Concept, meaning and measurement of national income.

Module 7:

Money: Concept and meaning of money, supply and demand of money, inflation- meaning and effect.

Course Outcomes: After completion of the course, the learners will be able to:

1. Analyze the economic requirements, the system of economic functions and correlate scarcity with the requirements.
2. Evaluate demand and analyze cost so as to optimize cost-production combination
3. Recognize the existing market and can take appropriate decisions.
4. Analyze different national income components for effective economic decisions.
5. Evaluate the inflationary situation and make appropriate plan.

Text Books:

1. Principles of Economics- S. K. Agarwal
2. Business Economics- M.J. Mankar
3. Managerial Economics- D. N. Dwivedi
4. Business Economics- Atmanand

Reference Books:

1. Microeconomics-Theory and applications, G.S.Maddala & Ellen Miller
2. Microeconomics- R.G. Hubbard, Anthony P.O. Brien

Course code: PE 6009
Course title: Engineering Economy

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Class schedule per week: 3 classes per week
Course Objectives: This course enables the students:

1. To know the fundamentals of Accounting and the reports required at the end of financial period
2. To explain how to determine selling price of a product manufactured in a factory
3. To explain use of breakeven analysis as a tool for decision making in a business
4. To assess the best feasible investment proposal among the alternatives based on the common index
5. To know the methods of calculating depreciation and reflecting them in financial reports at the end of accounting years

Syllabus:
Module 1
Accounting of Business Transactions: Accounting principles, journal and ledger entries, balance sheet, profit and loss statement, ratio analysis
Module 2
Cost and Cost Analysis: Cost structure, methods of allocating overhead costs, standard cost, concept of opportunity cost, sunk cost, fixed cost and variable cost
Module 3
Break Even Analysis: Drawing of brake even charts, effect of different variable on breakeven point, cost comparison of two or three alternatives
Module 4
Time Value of Money: Single sum and series of cash flow, uniform and gradient series, multiple compounding periods in a year, continuous compounding, bonds
Module 5
Comparison of Alternative Proposals: Bases of comparison- present worth amount, annual equivalent amount, future worth amount, rate return, defining mutually exclusive alternatives, decision criteria for selection of investment proposals, comparison of alternatives, with unequal service life, sensitivity analysis\
Module 6
Replacement Analysis: Reasons for replacement, evaluation of replacement involving excessive maintenance cost, decline in efficiency inadequacy and obsolescence
Module 7
Depreciation and Decision Making Under Uncertainty: Methods of depreciation and their comparison, decision making on the basis of expected value decision tree in the evaluation of alternatives

Course Outcomes: After completion of the course, the learners will be able to:

1. Explain about accounting system and how to make balance sheet of organization
2. Calculate cost and its element and correlate with company break even.
3. Identify and analyze the value of money with respect to time and solve different problem of different methods.
4. Solvethe problem of different alternatives method for analyzing of project cost and time, study about replacement method and its solution.
5. Evaluate and formulate deprecation and its element and to take decision under different Uncertainty.

Text Books:

1. Modern Accountancy — I.M. Pandey
2. Engineering Economy — E. P. Degarmo

Reference Books:

1. Engineering Economy — S. J Thusen
2. Engineering Economy — Smita Sinha

SESSIONAL / LABORATORY:

Course code: EE6202
Course title: Control System Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Fundamentals of Mathematics and Physics, Introduction to System Theory, Control Theory
Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students:

1. To outline and explain
   Basic components used in control system
   Specifications used for a system in time domain and frequency domain
2. To illustrate performance characteristics of DC motor, AC Servomotor, PID controller and compensating networks.
3. To apply comprehensive knowledge of techniques used to analyse system and solve problems
4. To evaluate the performance of systems and assess stability of a system

List of Experiments:

1. **Name: On- off temperature controller**
   Objective: To study the characteristics of On-Off temperature control to show the effect of parameter variation on: Temperature Vs Time characteristics
   : Power Vs Time characteristics
2. **Name: First order and second order system**
   Objective: To study the response of first order and second order RLC series circuit.
   Derive the transfer function and find the time response specification from the time response.
3. **Name: Root Locus**
   Objective: To draw the root loci of a given transfer functions and verify it using MATLAB.
4. **Name: Bode plot**
   Objective: To draw the Bode plot of a given transfer functions manually and verify it using MATLAB. Analyse the system for different varying parameter and comment on stability.
5. **Name: Nyquist Plot**
   Objective: Solve the given transfer function and draw the Nyquist in a simple graph sheet manually. Analyse the stability of the given system using Nyquist Stability Criteria and verify it using MATLAB.
6. **Study of synchros and servomotor**
   Objective: Study the principle of operation, application of syncros and measurement of angular displacement Vs AC voltage.
   Study the principle of operation, classification and application of different servo motor.
   Study the principle of operation, classification and application of potentiometer.
7. **High pass and low pass Filter**
   Objective: Study of high pass and low pass Filter characteristics using RC component, sine wave generator and Lissajous pattern.
   Draw magnitude and phase plot.
8. **Effect of poles and zeros**
   Objective: Solve the given transfer function and study effect of addition of poles and zeros on a specified system.
   Effect in terms of time response
   Effect in terms of frequency response.
   Effect on Time and frequency response for complex conjugate poles and zeros in forward and backward path.
9. **study of motor and brake characteristics**
   Objective: to learn the steady state speed of motor is ideally proportional to applied voltage.
   To determine the time constant of given motor.
10. **Name: Design of filter using Op-amp**
    Objective: design of filter using operational amplifier (Op-amp) series from given Transfer function.

Course Outcomes

After the completion of this course, students will be:

1. Able to examine performance of basic components of a system and describe various specifications used for a system.
2. Able to clearly explain and interpret the performance characteristics of DC motor, AC Servomotor, PID Controller and compensating networks
3. Capable to establish the relation between time domain and frequency domain techniques
4. Able to solve problems and analyse stability of a system
5. Able to appraise various techniques and simulate them to analyse performance of a system

Text Books:

1. I J Nagrath and Gopal, Control System Engineering, New Age International Publication
2. K Ogata, Modern Control Engineering, Pearson Education

Reference Books:

1. Norman Nise, Control System Engineering, Willey Publications
2. Graham C Goodwin, Control System design, PHI
3. B C Kuo, Automatic Control System, PHI

Course code: **EE6208**
Course title: **Computer Aided Machine Design**

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): knowledge about basic principles of electrical engineering, knowledge about machines.

Class schedule per week: 3 classes per week

Course Objectives: This course enables the students to:

1. develop concept on CAD and knowledge on symbols of electrical components;
2. solve problems related to design of machines;
3. analyze on the design problems related to machine operation and control;
4. design various industrial circuits with proper specification and symbols.

Syllabus:

List of Experiments: Introduction to AutoCAD, Introduction to electrical symbols and its use in the circuit.

1. To design the core of single phase core type transformer.
2. Design the control & power circuit of Y - Δ starting of a machine.
3. To design the core of 3-φ core type transformer.
4. Design on the control circuit of operation of drilling and tapping operation.
5. Design of control & power circuit of forward and reverse operation of a machine.
6. Design on the control circuit of operation of press machine.
7. To design the core of single phase shell type transformer.
8. To design the core of 3-φ shell type transformer.
9. To study the design of stator 1-φ induction machine.
10. Design on the layout of a house with proper electrical connection.

Course Outcomes:

After the completion of this course, students will be able to:

1. develop knowledge on CAD;
2. outline the symbols, circuits and specification of electrical components;
3. understand and classify the design of machine;
4. identify and predict trouble shooting in circuit;
5. design & modify complex industrial circuit

Referred Books:

1. Testing & Commissioning of Electric Equipments - S. Rao.
2. Control of Electrical Machine - Dr. S. K. Bhattacharya, New Age International (P) Ltd.

Course code: EE6210
Course title: Electrical Workshop

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Knowledge of electrical machine, switchgear, and protective devices, and circuit & symbols.
Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students to:

1. understand the concept of Indian Electricity Rules, Safety precautions, First Aid, Tools, Measuring Instruments and Specifications;
2. design and construct Single Phase Transformer;
3. design, construct, and explain different types of circuits for domestic, and commercial electrification;
4. design, construct, and test various types of Relay Logic Circuits used in industries.

List of Experiments :

1. **Name: Study of IER, First Aid, Measuring instruments, tools, and symbols.**
   a. Aim: (a)Introduction to safety precautions, elementary first aid, and treatment of electrical shocks.
   b. (b) Introduction to Tools, Measuring instruments, and symbols of electrical components, and devices.
   c. (c) Introduction to Indian Electricity Rules pertaining to domestic electrification, industrial electrification, and earthing.
2. **Name: Cable Jointing**
   a. Aim: Different types of joints of conductors: Splice joint, Britannia joint, married joint, and sleeve joint.
3. **Name: Testing and trouble shooting of motor and cables.**
   a. Aim: Testing and trouble shooting of induction motor. DC motor, Transformer, and Cable.
   Continuity Test
   Insulation resistance test between phase winding and phase winding to earth.
   Polarity Test.
4. **Name: Domestic Electrical circuits**
   a. Aim :Explain with the help of circuit diagram. How the single phase supply enters the energy meter and leaves the distribution load with one light sub circuit and power sub circuit.
5. **Name: Domestic field circuit**
   a. Aim: Draw a schematic and also construct the following arrangements.Switch on and off a lamp, a fan, a call bell and switch on and off a lamp from two places.
6. **Name: Starter for Induction motor**
   a. Aim:In a workshop a 5H.P., 400V and 50 Hz 3-phase squirrel cage induction motor needs to be run withInterlock switches. Suggest a automatic starter and construct it.
7. **Name: Starter to run motor in both directions**
   a. Aim :Construct a starter to run above motor in both directions manually with the help of a push button or automatically using limit switches. Also interlock the operation of another motor with main motor.
8. **Name: Starter for 3-Phase**
   a. Aim: To observe Direct on line starting of 3-phase induction motor with control circuit.
9. **Name: Design of Small Transformer.**
   a. Aim: Design a single phase two winding Transformer suitable for 230/240V, 50Hz having a rating of 100VA. The secondary voltage is 24V. Make suitable assumptions.
10. **Name: Domestic Power Circuit.**
    a. Aim: Connect a power socket to power sub-circuit.

Referred Books:

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipments - S. Rao, 6th Edition, ISBN -9788174091858, 8174091858, Khanna Publishers-Delhi.
2. Control of Electrical Machines – Dr. S. K. Bhattacharya, Brijendra Singh, Reprimtedi ISBN – 9788122418187, 812241818X, New Age International(P) Limited 2016, Publishers.
3. Electrical Design Estimating and Costing – K. B. Raina and S. K. Bhattacharya, ISBN – 8122403368, 9788122403633, New Age International(P) Limited 2010, Publishers.
4. Electrical Installation Estimating and Costing – J. B. Gupta, 9th Edition ISBN – 9350142791, 9789350142790, S. K. Kataria & sons, Publishers.

Semester: 7

Course code: EE7203
Course title: Switchgear and Protection

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge in Electrical Machines, Power Transmission and Distribution, Measurement and Instrumentation, Analysis of Power System.

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. To outline significance of protective devices in power system network
2. To explain the principle of operation, types of relays and circuit breakers.
3. To classify the protection mechanism of generation transmission and distribution and it's significance at individual location.
4. To analyze the significance of electromechanical relays for applying it in numeric relays.

Syllabus

MODULE – I : Circuit Breakers: Arc voltage, Mechanism of arc interruption, Restriking voltage and recovery voltage, Classification of CBs, Oil CBs, Air CBs, Vacuum CBs, Sf6 CBs, HVDC CBs, Rating and Testing of CBs.

MODULE – II: Protective Relaying: Introduction to protective relaying, Thermal relay, Over current relay, Directional relay, Differential relay.

MODULE – III: Transmission Line and Feeder Protection: Over current and directional relay applications, Distance protection using impedance relay, Reactance relay, MHO relay.

MODULE – IV: Generator Protection: Protection against stator and rotor faults and abnormal operating conditions such as unbalanced loading, loss of excitation, Over speeding.

MODULE – V: Transformer Protection: Types of faults, Over current protection, Differential protection, Differential relay with harmonic restraint, Protection against high resistance ground faults, Inter-turn faults, Buchholz relay.

MODULE – VI: Introduction Motor Protection: Protection against phase fault, ground fault and abnormal operating conditions such as single phasing, Phase reversal and overloading.

MODULE – VII: Introduction to Carrier: Aided Protection and Numerical Protection

Course Outcomes:

After the completion of this course, students will be able to:

1. Outline of the power system protection mechanism significances.
2. Explain the operation, classification and structure of the relays and circuit breakers.
3. Classify and relate the protection mechanism at different zones of power system, such as HL1, HL2 and HL3.
4. Analyze and differentiate numeric relays with electromechanical relays.
5. Ability to predict and design the protection mechanism at different zones of power system as per the modernization of the grid.

Text Books:

1. Power System Protection & Switch Gear : Badriram and Vishwa Karma, TMH Publications, 2nd edition, 2013.
2. Switch Gear and Protection Sunil S. Rao, Khanna Publications, 3rd edition, 2008.

Reference Books:

1. Power System Protection & Switch Gear: Ravindranath & Chander, New Age Publications, 2nd edition, 2014.
2. The Art and Science of Protective Relaying: C. Russel Mason, Wiley Bastern Ltd,1956.

Elective-I:

Course code: EE7211
Course title: Computer Aided Power System Analysis

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge of basic principles of power system and its analysis

Class schedule per week: 3 classes per week

Course Objectives: This course enables the students:

1. To identify adequate single-phase modeling for power system components.
2. To explain steady state operation of large-scale power systems and to solve the power flow problems using efficient numerical methods suitable for computer simulation.
3. To analyze power systems under abnormal (fault) conditions utilizing bus impedance matrix.
4. To assess and design optimal system operation and infer about the dynamics of power systems for small and large disturbances.

Syllabus

MODULE – I: Introduction: The new computer environment, Basic single-phase modeling- Generator, Transmission lines, Transformer- Off nominal transfer tap representation, Phase shifting representation.
MODULE – II: Load Flow Analysis: Introduction, Nature of load flow equations, Computational steps and flow chart of Gauss Seidal Techniques, Newton Raphson method: Formulation for load buses and voltage controlled buses in rectangular and polar co-ordinates, Computational steps and flow chart.
MODULE – III: **Computational Aspects of Large-Scale System:** Sparsity of Y_{bus} and Jacobian matrix, Sparsity oriented computer programming, Reducing storage requirement, Decoupled power flow algorithm.
MODULE – IV: Optimal System Operation: Introduction, Characteristic of steam and hydro units, Economic dispatch of thermal units, Equal incremental cost operation, Computational steps, Transmission loss and incremental transmission loss (ITL), Computational aspects.
MODULE – V: Unit Commitment: Introduction, Objective function, Constraints, Dynamic programming method.
MODULE – VI: Short Circuit Analysis: Introduction, Bus impedance matrix and its building algorithm through modifications, Symmetrical and unsymmetrical fault calculation using Z_{bus} and its computational steps
MODULE – VII: Power System Stability: Stability problem, swing equation and its numerical solution, Determination of initial state in a multi-machine system, Base case Y-BUS and modified Y-BUS, Computational algorithm, Improvement of stability.

Course Outcomes:

After completion of the course, the learners will be able to:

1. To outline efficient use of computer in solving practical power system problems.
2. To explain and relate different methods for solving the load flow problems.
3. To identify and analyze the different abnormal (fault) conditions in power system utilizing efficient computer algorithm.
4. To solve economic load dispatch problem with and without transmission losses and also to solve unit commitment problem by Dynamic programming method.
5. To evaluate and formulate different methods of improving the transient stability of a large practical power system.

Text Books:

1. Computer Techniques in Power System Analysis – M. A. Pai, McGraw Hill, New Delhi, 2nd edition, 2003.
2. Advanced Power System Analysis and Dynamics - L. P. Singh, New Age International, 4th edition, 2006.

Reference Books:

1. Computer Modelling of Electrical Power Systems - J. Arrillaga, N.R. Watson, Wiley, 2nd edition, 2001.
2. Power Generation Operation and Control - A.J. Wood, B.F. Wollenberg, 2nd edition Wiley Inderscience publication.

Course code: EE7213
Course title: Microprocessor Applications

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I & II
Architecture and Application oriented assembly language programming on Intel 8086/8088 family of microprocessors on a P.C. Assembly language programming using DOS and BIOS function calls, using keyboard, display, I/O, Printer, and RS232C port functions.

MODULE – III
Assembly programming using MASM with code view facility with all assembler directives, source level debugging and use of watch windows to identify programme errors. Programming the Numeric processor (Intel 8087 NDP)

MODULE – IV & V
Architecture and Application oriented programming, using MC 68000 family of processors. Use of development systems, Assembling, linking and debugging.

MODULE – VI & VII
Architecture and Assembly language programming using Z-80 family of microprocessors, Real time Emulation, and simulation for application programmes, Programme development, hardware configuration and software design examples using:

A/D - D/A interface with processors.
I/O - interfacing using Intel 8255, MC 6820 - 6822, Z-80 PIO.
Video I/O using MC 6845 or Intel 8275.
Serial I/O using Intel 8251/Z-80-CTC.
Floppy disk controller Intel 8272.
Dynamic RAM Controller Intel 8202 family.
DMA Controller Intel 8237 Chip

Text Books:

1. Liu, Yu-Chang and Gibson, Glenn, A., “Microcomputer Systems, The 8086/8088 Family”, PHI, New Delhi.
2. Leventhal, L.A., et al., “68000 Assembly Language Programming”, Second Edition, Osborne Mc-Graw-Hill International Editions, Berkley, California, USA.
3. Osborne, Adan and Kane, Jerry, “An Introduction to Microprocessors,” Volume-2, Parts A and B, Galgotia Book Source, Publishers, P.O. Box 688, New Delhi - 110001.
4. Douglas V. Hall, "Microprocessors and Interfacing: Programming Hardware", First/Second Edition, TMH Publishing Company Ltd., New Delhi.

Course code: **EE7215**
Course Title: **Bio-electronics Instrumentation**
Credits: **L T P C**
3 0 0 3
Pre-requisite(s): Basic knowledge of electronics components, electronic instrumentation and basic idea on human organ systems.
Class per week: **3 classes per week**
Course Objectives:
This course enables the students:

1. To impart knowledge for interdisciplinary and applied engineering and technology.
2. With respect to design consideration, understand the standard structure of biomedical instrumentation systems.
3. To learn the technicality associated with instrumentation and design and basic biosignal and imaging equipment.
4. To understand the engineering aspects for safety and hazards associated with biomedical instruments.

Syllabus

MODULE – I: Introduction, Medical instrumentation system Man instrumentation system, Brief idea of cardiovascular, Nervous & respiratory system.
MODULE – II: Resting & action potential, Polarization & depolarisation, Propagation & action potential, Bioelectronic potential.
MODULE – III: Biopotential electrode, Active & passive transducers, biochemical transducers.
MODULE – IV: ECG electrodes & leads, Measurement of blood pressure, blood flow & heart sounds.
MODULE – V: Noninvasive instrumentation, Patient monitoring system, Electrical safety of patients in hospital, defibrillator, pace maker.
MODULE – VI: Amplifiers & recorders, Diathermy (Microwave) structure & ultrasonic), imaging system (X-ray, MRI & ultrasonic), lasers in medicine.
MODULE – VII: Biomedical DSP.

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

1. understand the general physiology for man-machine interaction in medical environment;
2. understand the fundamentals of the concept and design of biomedical equipment;
3. understand the importance of medical data transmission for better healthcare;
4. identify the electrical hazards associated with medical equipment so that the safety equipment can be devised or suggested;
5. work in an interdisciplinary team.

Text Books:

1. Handbook for Biomedical instrumentation by R. S. Khandpur, 3rd edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2014.
2. Biomedical Digital Signal Processing by W. J. Tompkin, 1st Edition, Printice Hall of India, New Delhi, 2000.

Reference Books:

1. Biomedical Engineering and Instrumentation, Basic Concepts and Applications by J. D. Bronzino, 1st Edison, PWS Publishers, Boston, 1986.
2. Medical instrumentation, Application & Design by J. G. Webstar, 4th edition, Wiley Student Edition, New Delhi, 2009.
3. Introduction to Biomedical Equipment Technology by J. J. Kar and J. M. Brown, 4th edition, Pearson India Education Services Pvt. Ltd., Noida, 2016.

Course code: **EE7217**
Course Title: **Neural Networks**

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Introduction: Brain & Machine, Biological Neurons & its mathematical model, Artificial Neural Networks, Benefits and Applications, Architectures, Learning Process (paradigms & algorithms), Correlation Matrix Memory, Adaptation.

MODULE – II

Supervised Learning I: Pattern space and Weight space, Linearly & non Linearly separable classes, Decision Boundary, Hebbian learning & limitation, Perceptron, Perceptron convergence theorem, Logic Functions implementations.

MODULE – III

LMS Algorithm: Wiener-Hopf equations, Steepest Descent Search method, LMS algorithm, Convergence consideration in mean & mean square, Adaline, Learning curve, Learning rate annealing schedules.

MODULE – IV

Supervised Learning II: Multilayer Perceptrons, Backpropagation algorithm, XOR Problem, Training modes, Optimum learning, Local minima, Network Pruning techniques.

MODULE – V

Unsupervised Learning: Clustering, Hamming Networks, Maxnet, Simple competitive learning,Winner-Take-All Networks, Learning Vector Quantizers, Counterpropagation Networks, Self Organising Maps (Kohonen Networks), Adaptive Resonance Theory.

MODULE –VI

Associative Models: Hopfield Networks (Discrete and continuous), Storage capacity, Energy Function & minimization, Brain-State-in-a-Box Neural Network.

MODULE – VII

Applications of ANN & Matlab Simulation: Character Recognition, Control Applications, Data compression, Self organizing semantic Maps.

Text Books:

1. Neural Networks: A Comprehensive Foundation – Siman Haykin. (Pearson Education).
2. Elements of Artificial Neural Networks – Kishan Mehrotra, Chilukuri K. Mohan, Sanjay Ranka. (Penram International Publishing, India)

Reference Book

1. Neural Networks: A Classroom Approach – Satish Kumar, Tata McGraw Hill

Course code: **MEE1119**
Course Title: **Control System Design**

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

Module 1: Performance characteristics of feedback control system & design specification of control loop. Different types of control system applications and their functional requirement. Derivation of load-locus (toque/ speed characteristics of load). Selection of motors, sensors, drives. Choice of design domain & general guidelines for choice of domain. Controller configuration and choice of controller configuration for specific design requirement. Fundamental principles of control system design. Experimental evaluation of system dynamics in time domain and frequency domain.

Module 2: Design with PD Controller: Time domain interpretation of PD controller, frequency domain interpretation of PD controller, summary of the effects of PD controller. Design with PI controller: Time domain interpretation of PI controller frequency domain interpretation of PI controller, summary of the effects of PI controller, design with PID controller, Ziegler Nichols tuning & other methods.

Module 3: Design with lag/lead/lag-lead compensator, time domain interpretation of lag/lead/lag-lead compensator, frequency domain interpretation of lag/lead/lag-lead compensator, summary of the effects of lag/lead/lag-lead compensator.

Module 4: Forward & feed-forward controller, minor loop feedback control, concept of robust design for control system, pole-zero cancellation design.

Module 5: Sate feedback control, pole placement design through state feedback, state feedback with integral control, design state observer.

Module 6: Design of Discrete Data Control System: Digital implementation of analog controller (PID) and lag-lead controllers, Design of discrete data control systems in frequency domain and Z plane.

Module 7: Hardware and Software Implementation of Common Compensator: Physical realization of common compensator with active and passive elements, tunable PID algorithms- position and velocity algorithms.

Text Books:

1. B.C. Kuo, "Automatic Control System", 7th Edition PHI.
2. M. Gopal, "Control Systems Principles & Design", 2nd Edition, TMH.
3. J.G. Truxal, "Automatic Feedback Control System", McGraw Hill, New York.
4. K. Ogata, "Discrete Time Control Systems", 2nd Edition, Pearson Education.

Reference Books:

1. Norman Nise, "Control System Engineering", 4th Edition.
2. M. Gopal, "Digital Control & State Variable Method", TMH.
3. B.C. Kuo, "Digital Control System", 2nd Edition, Oxford

Course code: **MEE1151**
Course title: **Advanced Power Electronics**

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Operating Principle of Semiconductor Devices
Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students:

1. Introduction of different type of modern semiconductor based switching devices and their operating characteristics
2. Explanation of working principle of power converters and relate them with different area of application.
3. Analysis of closed loop control of electrical drives based on power converters. Differentiation between different control strategy of electrical drives in terms of dynamic parameters of system and overall efficiency.
4. Performance evaluation, planning and design procedure for a complex power electronics based system.

Syllabus
MODULE – I : Introduction: Power Electronic Devices: (Diodes, Thyristors), Transistors, MOSFET, IGBT, IGCT, etc.- operating principle, Static & dynamic characteristics, Data sheet ratings; Thermal characteristics of power devices; Sample Gate drive circuits;
MODULE – II : Switched Mode Power Supply: Forward and flyback converter circuits: operation, waveforms analysis, small signal analysis of DC-DC converters and closed loop control.
MODULE – III : Resonant Converters: Operating principle, waveforms analysis, switching trajectory, losses and control.
MODULE – IV : PWM inverter modulation strategies & dual bridge: Sine wave with third harmonic, space vector modulation and predictive current control techniques; PWM rectifier; Input side bidirectional power flow requirement for regeneration & Dual thyristor bridge.
MODULE – V : AC-AC Converter : Cycloconverters: Circuit, operating principle, control, harmonics, power factor and applications; Non-drive application of power electronic converters: Matrix Converter- circuit and its operation.
MODULE – VI : Multi- level inverter : Basic topology and waveform, improvement in harmonics and high voltage application;
MODULE – VII : Introduction to application oriented chips: Industrial PWM driver chips for power supplies such as UC 3843, 3825 or equivalent; Industrial gate driver chips for PWM voltage source inverters with isolation and protection circuits. Intelligent power modules.

Course Outcomes:
After the completion of this course:

1. Understanding: List different types of semiconductor devices and remember their operating characteristics. Explain working principle of different semiconductor devices.
2. Application: Classify different types of power converters. Show suitability of a power converter for a particular application. Solve power management related problems with application of power electronics based topologies.
3. Analysis: Out line shortcomings of each class of power converters and solve them using proper modifications. Identify potential area for power electronics applications.
4. Evaluation: Estimate the cost and long term impact of power electronics technology on a large scale project of socio-economic importance.
5. Creation: Modify existing power electronics based installations. Design new power converter topologies and Plan to develop a power processing unit for a particular requirement in industrial plants as well as domestic applications. Lead or support a team of skilled professionals.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Device and Applications",2nd Ed.n, PHI, New Jersey, 1993.
2. Mohan, Underland, Robbins; Power Electronics Converters, Applications and Design, 3rd Edn., 2003, John Wiley & Sons Pte. Ltd.
3. M. D. Singh, K. B. Khanchandani, "Power Electronics", 2nd Edn., Tata McGraw-Hill, 2007.

Reference Books:

1. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control ", 1st Edn., Prentice Hall,2001.
2. B. K. Bose, "Modern Power Electronics & AC Drives" , 1st Edn., Prentice Hall, 2001.
3. L. Umanand, "Power Electronics: Essentials & Applications", 1st Edn. Wiley India Private Limited, 2009.
4. Jeremy Rifkin, "Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World", 1st Edn., St. Martin's, Press, 2011.

Breadth Papers:

Course code: MSH1103
Course title: Business Ethics

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge of basic principles of business ethics education in general
Class schedule per week: 3 classes per week
Course Objectives:

1. Define business ethics and examine its importance and also detect some of the ethical issues that may arise in business.
2. To distinguish between ethics, morals, values, codes of conduct and the law.
3. To explain and illustrate the social responsibility and explain its relevance to business.
4. To study a series of cases focusing on contemporary issues. Examine the evolution of corporate governance and its practice.
5. To explain and illustrate the importance of Ethics of consumer protection and its marketplace
6. Provide the skills with which to recognize and resolve ethical employee issues in business.
7. To explain and illustrate the Roles and Responsibilities of an individual in the present social context.

Syllabus:

Module-1
Introduction to business ethics, ethical principles in life, utilitarianism justice and fairness

Module-2
Social responsibility of business organisations

Module-3
Introduction to corporate governance

Module-4
Ethics of consumer protection, relevance of ethics in marketplace

Module-5
.Business and its internal constituencies, employee issues

Module-6
Indian value system and it`s utility in present context

Module-7
Roles and responsibilities of an individual in the present social context.

Text Books:

1. Business Ethics concept and cases: Valesquez -TMH Publication
2. Human Values-A.N. Tripathi-New age Publication
3. Ethics in Management and Indian ethos-Biswanath Ghosh-vikas publication
4. Ethics in Management-arya kumar-Anne books Pvt. limited

Course code: MSH1109
Course title: Entrepreneurship and Small Business Management
Credits: L T P C

3 0 0 3

Pre-requisite(s): Knowledge of basics of Entrepreneurship and developing Small scale business
Class schedule per week: 3 classes per week
Course Objectives: This course enables the students:

1. To know the concept of Entrepreneurship
2. Contribution of Small enterprise to the economy
3. To know the various sources of finance so as to arrange funds for the new business idea
4. Introduction of laws relating to intellectual property right in India

Syllabus:

Module I
Introduction:
Definition, Concept of Entrepreneurship & Intrapreneurship, Characteristics and skills of entrepreneurs
Module II
Entrepreneurial Development:
Entrepreneurship & Economic development, Contribution of Small enterprises to the economy, Entrepreneurial environment, Types of Entrepreneurs.
Module III
Developing the Business Plan:
Identification of Business idea, Elements of a Business Plan, Building Competitive Advantage, Conducting feasibility Analysis.
Module IV
Sources of Finance
Equity vs. Capitl, Sources of Equity Finance, Institutional finance, Venture Capital, Lease Finance,
Module V
Forms of Business Ownership
Sole Proprietorship, Parternership, Corporations and other forms of ownership
Module VI
Intellectual Property Management: Importance of innovation, patents & trademarks in small business, introduction relating to IPR in India.
Module VII
Institutional support for small businesses in India: Support in ares of technology, finance, inputs & infrastructure, marketing, entrepreneurship development.
Course Outcomes: After completion of the course, the learners will be able to:

1. Outline efficient use of managerial skills in solving real life problems.
2. It will help into selecting the best form of enterprise and the optimal capital structure of the enterprise.
3. This course will help them to do feasibility analysis for the project to be undertaken.
4. To make strategic management decision making for the enterprise

Text Books:

1. Hisrich& Peters, Entrepreneurship, Tata McGraw Hill
2. Norman M. Scarborough, Essentials of Entrepreneurship & Small Business Manageent 6th ed., Prenkticke Hall
3. Roy, Rajeev, Entrepreneurship, Oxford University Press
4. Dutta, Bholanath, Entrepreneurship management, Excel Books.

List of Elective – I Sessional:

Course code: EE7212
Course title: Computer Aided Power System Analysis Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Principles of Electrical Engineering, Power System, MATLAB Programming
Class schedule per week: 3 classes per week
Course Objectives:

This course enables the students to:

1. enable the students to apply different equations used in load flow analysis and thereby applying the analysis for line overloading removal and voltage improvements, rating selection of protection devices for different types of short-circuits;
2. expose the students about the necessity of economic operation power systems through cost efficient power dispatch;
3. develop classical and numerical solution techniques for understanding angle stability;
4. teach the students about the ways of representation of power system network and thereby simulate different situations occurred in the network.

List of Experiments :

1. Simulation of IEEE 14 and IEEE 30 bus system.
2. Study and analysis of the load flow result for IEEE 14 and 30 Bus systems.
3. Variation of voltage magnitude and angle with variation of real and reactive power at any load bus.
4. Comparison between Gauss Siedal and Newton Raphson method for load flow analysis.
5. Study of line performance at different conditions and placement of Reactive VAR compensators as per requirement.
6. To examine the effect of line outage of IEEE 30 bus system and to reduce the overloading by generation re-scheduling.
7. Economic Load Dispatch of Generators neglecting transmission loss.
8. Economic Load Dispatch of Generators considering Transmission loss.
9. Study of symmetrical and unsymmetrical fault analysis and to observe the result by creating faults at different buses.
10. Power System Stability analysis.

Course Outcomes:

After the completion of this course, students will be able to:

1. understand the purposes and importance of simulating the power system network;
2. simulate the network for the purpose of obtaining the solution at short circuit condition, Economic Load dispatch, reactive VAR compensation and load flow analysis;
3. develop mathematically different contigent cases and situations occurred from different disturbances and thereafter the consequences arised from each case;
4. suggest the solutions for every case;
5. comprehend and write technical observations referring the results for each case.

Text Books:

1. Power System Analysis – Hadi Saadat, Tata McGraw-Hill Edition, 2002.
2. Electric Power System – C. L. Wadhwa, 6th edition, 2013, New Age International Publishing.

Reference Books:

1. Modern Power System Analysis – D. P. Kothari, I. J. Nagrath, 4th edition, 2014, Tata-McGraw Hill.
2. Electric Energy Systems Theory - An Introduction – O. I. Elgerd, 27th reprint, 2007, TMH.
3. Power System Engineering – A. Chakrabarti, M. L. Soni, P. V. Gupta, U. S. Bhatnagar, 4th edition, 2008, Dhanpat Rai & Co.

Course code: **EE 7216**
Course title: **Bio-electronics Instrumentation Lab**

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Basic knowledge of electronics components, electronic instrumentation and basic idea on human organ systems.

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. To impart knowledge for interdisciplinary and applied engineering and technology.
2. To provide knowledge about different physiological parameters and associated measuring sensors
3. To impart practical knowledge about the application of biomedical equipment.
4. To make them learn about the general processing tools for biomedical signal analysis

Syllabus:

List of Experiments:

1. **Electromyography(EMG)**
   i. To observe and record skeletal muscle tonus as reflected by a basal level of electrical activity associated with muscle in resting state.
   ii. To record and analyze maximum clench strength for right for right and left hands.
2. **Electroencephalography (EEG)**
   i. To record an EEG from an awake, resting subject with eyes open and eyes closed.
   ii. To identify and examine delta. Theta, alpha and beta spectral components of EEG waves.
3. **Electrocardiography (EEG)**
   i. To analyze and compare electrical events of the ECG with the mechanical events those occur during cardiac cycle.
   ii. To analyze the ECG from Lead-I, Lead- II and Lead- III and correlate the direction of QRS complex(+ or -) with the direction of the lead axis.
4. **Electrooculogram (EOG)**
   i. Compare eye movements when fixed on a stationary object as well as while tracking objects.
   ii. Measure duration of saccades and fixation during reading.
   iii. Record spatial position of eye movements during visual examination of materials.
5. **Blood Pressure**
   i. To use an auscultatory method for an indirect determination of systematic arterial systolic and diastolic blood pressure and to correlate the appearance and disappearance of vascular sound with systolic and diastolic pressure, respectively.
   ii. To compute and compare pulse pressure and mean arterial pressure.
6. **Pulse Function**
   i. To observe experimentally, record and calculate selected pulmonary volumes and capacities.
   ii. To compare the observed values of volume and capacity with average values.
7. **Pulse Plethysmography**
   i. To become familiar with the principal of plethysmography and its usefulness in qualitatively assessing peripheral changes in blood volume.
   ii. To observe and record charges in peripheral blood volume and pressure pulse under a variety of both experimental and physiological conditions.
8. **Phonocardiography**
   i. To correlate the human heart sound with the cardiac electrophysiology.
   ii. To analyze the nature of the phonocardiography change in the relationship between electrical and mechanical structure with EEG wave.
9. **Ultrasound**
   i. Identification of different cardiac anatomical structures with ultrasound.
   ii. Correlation of cardiac wall movement and valvular mechanics with EEG wave.

10. **Polygraphic analysis of Mental Stress**
    i. To observe and record polygraphic signals (respiratory rate, heart rate, pulse rate and skin resistance) to analyze the degree of mental stress/effort with increasing complexities of arithmetic mental tasks.

Course Outcomes:

After the completion of this course, students will a student will gain skilful knowledge of:

1. Working with the biomedical equipment;
2. Fundamentals of the types of biomedical sensors and transducers for biomedical data acquisition;
3. General idea on the digitization of biomedical signals;
4. Fundamentals of bio-signals and their pattern analysis;
5. work in an interdisciplinary team.

Text Books:

1. Handbook for Biomedical instrumentation by R. S. Khandpur, 3rd edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2014.
2. Biomedical Digital Signal Processing by W. J. Tompkin, 1st Edition, Printice Hall of India, New Delhi, 2000.
3. Biopac Student Lab., Laboratory Manual (Available with Biopac Systems installed in Biomedical Instrumentation Lab.).

Reference Books:

1. Biomedical Engineering and Instrumentation, Basic Concepts and Applications by J. D. Bronzino, 1st Edison, PWS Publishers, Boston, 1986.
2. Medical instrumentation, Application &Design by J. G. Webstar, 4th edition, Wiley Student Edition, New Delhi, 2009.
3. Introduction to Biomedical Equipment Technology by J. J. Kar and J. M. Brown, 4th edition, Pearson India Education Services Pvt. Ltd., Noida, 2016.

Course code: EE7222
Course title: Advanced Power Electronics Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Operating principle of semiconductor based switching devices and firing circuit
Class schedule per week: 3 classes per week
Course Objectives:
This course enables the students:

1. Knowledge: Identify semiconductor switching devices and carryout experimentation to transfer and output characteristics and understand the operation of drive circuits, forced commutation circuits for the semiconductor switches.
2. Application: Apply knowledge of switching principle in different energy conversion topologies in order to draw the load voltage and current waveforms and validate through experimentation.
3. Analysis: Calculate the performance parameters of power converter topologies through practical and analytical approach.
4. Synthesis: Design a particular converter or inverter for a given specification of load duty cycle as a group project. And evaluate the performance of that power electronics based topology.

List of Experiments :

1. Name: Do an experiment on IGBT in order to obtain its Transfer and Output characteristics.
   Aim: (i) To obtain saturation, cut off and active region of a IGBT.
   (ii) To measure minimum gate voltage required for turning on IGBT

2. Name: Perform an experiment on Power MOSFET based step down chopper with R and RL load for drawing curve between boost factor and efficiency.
   Aim : (i) To find relative error between calculated and observed output load voltage of Step up Chopper with change in duty cycle.
   (ii) To draw curve between boost factor and efficiency for different switching frequency

3. Name: Do test on power circuit of impulse commutated chopper to study method of commutation and draw corresponding waveforms.
   Aim : (i) Experimental validation of condition for impulse commutation.
   (ii) To draw waveform across capacitor and load voltage.
   (iii) To obtain relation between duty cycle and output average load voltage.

4. Name: Execute an experiment on resonant pulse thyristor chopper circuit to study the method of commutation and draw corresponding waveforms.
   Aim : (i) Experimental validation of condition for resonant commutation.
   (ii) To draw waveform across capacitor and load voltage.
   (iii) To obtain relation between duty cycle and output average load voltage.

5. Name: Study and observe different methods of commutation (Class A, B, C)
   Aim: (i) To observe load voltage waveform under natural commutation.
   (ii) To observe load voltage waveform under forced commutation.

6. Name: Study of single phase rectifier inverter module with multiple PWM.
   Aim : (i) To obtain relation between modulation index and output RMS voltage.
   (ii) To develop algorithm for frequency control of line voltage of inverter output.

7. Name: Do an experiment to find the performance of single phase modified series inverter.
   Aim : (i) To differentiate between basic series inverter and modified series inverter.
   (ii) To obtain load voltage waveform for line frequencies below resonance and above resonance.

8. Name: Develop a simulation model on PSIM software for three phase VSI based motor speed controller

Aim : (i) Introduction to simulation using PSIM
(ii) To calculate of RMS output voltage and THD using PSIM
(iii) To obtain speed and torque characteristics of three phase VSI controlled induction motor

9. Name: Hardware based project in group.
   Aim : (i) Design of a power converter based on basic knowledge of power electronics
   (ii) Development of skills to function effectively as individual as well as a team member or as leader of team.
   (iii) Application of interdisciplinary skills.
   (iv) To think innovative ideas for possible engineering based solution for various social problems.

Course Outcomes:

After the completion of this course, students will be able to:

1. Identify different types of semiconductor based switching devices available in market.
2. Observe different characteristics of semiconductor based switching devices.
3. Choose a suitable and proper switching device for a required power electronics based design.
4. Experiment with conventional power converters.
5. Design simple and efficient power converters under laboratory conditions. Support a team as team member or play the role of team leader to implement projects in group.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Device and Applications",2nd Ed.n, PHI, New Jersey, 1993.
2. Mohan, Underland, Robbins; Power Electronics Converters, Applications and Design, 3rd Edn., 2003, John Wiley & Sons Pte. Ltd.
3. M. D. Singh, K. B. Khanchandani, "Power Electronics", 2nd Edn., Tata McGraw-Hill, 2007.

Reference Books:

1. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control ", 1st Edn., Prentice Hall,2001.
2. B. K. Bose, "Modern Power Electronics & AC Drives" , 1st Edn., Prentice Hall, 2001.
3. L. Umanand, "Power Electronics: Essentials & Applications", 1st Edn. Wiley India Private Limited, 2009.
4. Jeremy Rifkin, "Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World", 1st Edn., St. Martin's, Press, 2011.

Course code: E**E7204**
Course title: Power System Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Power system analysis and protection, A.C. & D.C. machines, power electronics, linear control theory.

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students to:

1. Apply theoretical knowledge for practical outcomes.
2. Handle and testing prototype models of the practical systems used in industries.
3. Show exposure towards physical significance of machineries.
4. Understand how to use various equipments.

Syllabus:

List of Experiments:

1. Power factor control of an inductive load.
2. Power system fault analysis using D.C network analyzer.
3. Determination of ABCD parameters and voltage profile for an artificial transmission line.
4. Determination of over current relay characteristics using Relay Test kit.
5. A micro- computer controlled static VAR compensator for receiving end voltage.
6. Determination of negative and zero sequence reactance of a 3-phase alternator.
7. Phase sequence determination using RC and two bulbs method.
8. Ferro- resonance phenomenon for a transformer at no load.
9. Determination of zero sequence impedance of 3-phase transformer.
10. Earth resistance measurement using Earth tester.

Course Outcomes:

After the completion of this course, students will be able to:

1. **Recall** the theoretical **knowledge** and practical outcomes.
2. **Understanding** the possible practical values of different experiments and individual parameters measured
3. **Apply** and **Analyze** the techniques, skills and modern engineering tools necessary for engineering practice
4. **Conclude** by justifying the output of the experimental output with theoretical and practical outputs respectively
5. Ability to **compile** the experimental data and **prepare** write-ups.

Referred Books:

1. Electric Machinery: 7th edition, Fitzgerald & Kingsley's Electric Machinery
2. Power System Protection & Switchgear: Badriram and Vishwa Karma, TMH Publication 2nd edition, 2014.
3. Performance and Design of DC Machines- A. E. Clayton, 1st edition, CBS Publisher, 2004.
4. Extra High Voltage AC Transmission Engineering (2nd Ed.) by R. D. Begamudre, Wiley Eastern Ltd.
5. Alternating Current Machines, A. S. Langsdorf, Tata McGraw-Hill, 2001
6. Microprocessor Architecture-Programming Applications by Ramesh S. Gaonkar, 5th edition, 1998 , Prentice Hall.
7. Power System Analysis, Stevenson and Grainger, 1994, Mc-Graw Hill
8. Electric Energy Systems Theory an Introduction, O.I. Elgerd, TMH,1973.
9. Power Electronics, M.D. Singh, K.B. Khanchandani, TMH, Delhi, 2001.
10. I.J. Nagrath & Gopal, "Control systems Engineering," 4th ed., New Age International Publication.
11. K. Ogata, "Modern Control Engineering," 3rd ed., Pearson Education.

Course code: EE7210
Course title: Minor Project
Pre-requisite(s): Latest Software skills; Knowledge on all the subjects related to all branches of engineering
Course Objectives:
This course enables the students:

1. The examiners to assess a candidate's knowledge in his or her field of learning.
2. To test a student's awareness of the latest developments and relate them to the knowledge acquired during the classroom teaching.
3. Students to apply the knowledge in practical field/design a prototype model for a particular application.

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

1. Face any kind of viva-voce, interviews, aptitude tests, group discussion, competitive exams, etc.;
2. Learn group living and work in a team;
3. Enhance communication skills and interactiveness through presentations;
4. Apply knowledge in building career in particular field;
5. Implement new ideas in particular field of learning and design a prototype model for a particular application.

Semester: 8

Elective – II

Course code: EE 8211
Course title: Information Technology

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Definition and Components of Information Technology: It's Need and Role in Technological/ Commercial/ Rural/ Industrial/ Socio-economic Developments, Entertainment Industries, and in sectors like: Education, Communication, Stock Exchange, Banking, Biomedical, Nuclear, Judiciary, Police & Intelligence Network, Central & State Governments, etc.

MODULE – I & II

Network Structures: Network Architectures - The QSI Reference Model - Connection - Oriented and connectionless Services - Transmission Media - Wireless, Analog and Digital Transmission - Transmission and Switching - Basic ISDN Concept - LAN, MAN & WAN - IEEE Standard 802 for LANs - Fibre Optic Networks - Satellite Networks - Data Link Layer Design Issues, Error Detection and Correction - HDLC Protocol - Network Layer Design Issues - Internetworking and OSI (Bridges, Gateways, etc.) - The Global Internet - TCP/IP Protocol.

MODULE – III & IV

Client/Server Models: Names for Computers in Internet - Services Available on the Internet (E-mail, E-com, Network News, FTP, TELNET, Browsing the Worldwide Web, World Wide Web Documents (HTML), Advanced Web Technologies, Automated Web Search, Audio and Video Communication, Global Digital Library etc.) - Main Features of some Example Internet Services - Security of Internet Services (Public Key Cryptography, Authentication and Digital Signatures).

MODULE – V

Elements of Interactive Computer Graphics for Multimedia: Primary and Secondary Colours - Beam Penetration Type Color CRT - Refresh Display Processors - Random Scan Line Displays - A Simple Graphics Package - Display Files - Graphical Input Devices and Techniques - Event Handling - Input Functions - Raster Display Hardware and Scan Conversion.

MODULE – VI

Multimedia Hardware & Software: Multimedia & Windows - Multimedia Hardware (Equipment, CD-ROM Drive, Sound Card, Sampling, Screen Display, Image Capture Card, etc.) - Sound Characteristics, Digital Audio, MIDI, & Media Player - Recording, Editing and Playing Back Sounds - Recording and Playing Back Images, Graphics, Video and Animation - Video Compression Methods - Using CD-ROMs - Hypermedia and Hypertext - Creating a Multimedia Presentation - Authoring Software- Internet and Multimedia.

MODULE – VII

Definition and Artificial Intelligence: Representation in AI - Properties of Internal Representation - First Order Predicated Calculus - Inferences - Abduction - Induction - Indexing - Semantic Networks - Isa Hierarchy - Slot Assertion Notation - Frame Notation - Context Free Grammars - Top-Down & Bottom-up Syntactic Parsing - Knowledge-base/Databases - Rule-based Programming - Expert Systems Design and On Line Information Retrieval.

MODULE – VIII

Information Technology as a Tool and Backbone for Modern Education System

Text Books:

1.Tanenbaum, Andrew. S, “Computer Networks”, Third Edition, Prentice-Hall of India, Pvt. Ltd., New Delhi, India.

2.Comer, Douglas E., “The Internet Book”, Second Edition Prentice-Hall of India Pvt. Ltd., New Delhi, India.

3.Newman, William M. and Sproull, Robert F., “Principles of Interactive Computer Graphics”, Second Edition, McGraw-Hill International Book Company, New Delhi, India.

4.Collin, Simon, “Multimedia Made Simple”, Asian Books Pvt. Ltd., New Delhi, India.

5.Charniak Eugene and McDermott, Drew, “Introduction to Artificial Intelligence”, Addison-Wesley Publishing Company, California, U.S.A.

6.Morris, Anne, Editor, “The Application of Expert Systems in Libraries and Information Centres”, Bowker-Saur, New York, U.S.A.

Course code: EE8213
Course title: Robotics

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Engineering Mathematics, Signal and systems, Control Theory, Basic programming knowledge.

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. To outline fundamentals of robotics and discuss different types of sensors and basic programming languages used for robotics
2. To describe direct and inverse kinematics of robots and to illustrate techniques used for planning robot motions in order to solve meaningful manipulation tasks.
3. To explain different methods for control of robotic manipulators.
4. To appraise the use of robotic vision in different field of robotics and compile all the techniques discussed.

Syllabus:

MODULE – I: Introduction of Robotics: Evolution of Robots and Robotics. What is and what is not a robot. Robot classification. Robot specifications. Robot applications. Direct Kinematics: Coordinate frames; Rotations; Homogeneous coordinates; D-H representation; The Arm Equation.

MODULE – II: Inverse Kinematics: Inverse kinematics problem. General properties of solutions. Tool configuration. Robotic work cell.

MODULE – III: Workspace Trajectory and Trajectory Planning: Workspace analysis. Workspace envelope. Workspace fixtures. Pick and place operation. Continuous-path motion. Interpolated motion. Straight line motion.

MODULE – IV: Control of Robot Manipulators: Computed torque control; Near Minimum time control; Variable structure control; Non-Linear decoupled feedback control; Resolved motion and Adaptive control.

MODULE – V: Robotic Sensors: Different sensors in robotics: Range; Proximity; Touch; Torque; Force and others.

MODULE – VI: Robotic Vision: Image acquisition. Imaging geometry, Image processing: Preprocessing; Segmentation and Description of 3-D structures; Recognition and interpretation.

MODULE – VII: Robot Programming Languages: Characteristics of Robot level languages. Task level languages: Task planning; Problem reduction; Use of predicate logic; Robot learning; Expert systems.

Course Outcomes:

After the completion of this course, students will be:

1. Able to enumerate characteristics of robots, sensors used and basic programming languages
2. Able to visualize and associate direct and inverse kinematics to real life problems.
3. Able to explain and analyse different techniques for planning robot motions and control of robotic manipulators
4. Able to assess the techniques of computer vision necessary in the field of robotics
5. Able to solve real life problems based on direct and inverse kinematics and simulate different controllers

Text Books:

1. Fundamental of Robotics: Analysis and Control - Robert J. Schilling, PHI Pvt. Ltd., New Delhi, 1990, Original Edition (Second Indian reprint)
2. Robotics: Control, Sensing, Vision and Intelligence - K. S. Fu, R.C. Gonzalez and Lee, McGraw Hill Book company, Singapore, 1987, International Edition

Reference Books:

1. Robotics and Control – R. K. Mittal and I. J. Nagrath, Tata McGraw Hill Pub. Company Ltd., New Delhi, 2003, ISBN 0-07-048293-4.

Course code: EE8215
Course title: High Voltage Engineering

Credit:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite: Fundamental of Electrical and Electronics Engineering, Engineering Electromagnetic, Electrical Measurement, Electrical Insulating Material
Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students:

1. To educate students about electric field stress
2. To give an exposure about different types of electrical insulation
3. To give information about conduction and breakdown in different types of electrical insulation
4. To impart knowledge about the methods of generation and measurement of high voltage and current for testing
5. To train the students for design of high voltage laboratory

Syllabus

MODULE – I: Introduction: Electric Field Stresses, Gas/Vacuum as Insulator, Liquid Breakdown, Solid Breakdown, Estimation and Control of Electric Stress
MODULE – II: Conduction and Breakdown in Gases: Gases as Insulating Media, Ionization Processes, Townsend's Current Growth Equation, Townsend's Criterion for Breakdown, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges, Post-Breakdown Phenomena and Applications, Vacuum Insulation.
MODULE – III: Conduction and Breakdown in Liquid: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure and Commercial Liquids.
MODULE – IV: Conduction and Breakdown Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical and Thermal Breakdown, Breakdown of Solid Dielectrics in Practice, Breakdown in Composite Dielectrics.
MODULE – V: Generation of High Voltage and Currents: Generation of High dc voltages, Generation of High alternating voltages, Generation of impulse voltages, Generation of impulse currents, Tripping and control of impulse generators.
MODULE – VI : Measurement of High Voltage and Currents: Measurement of High direct current voltages, Measurement of High ac and impulse voltages, Measurement of High impulse currents.
MODULE – VII: Design, Planning and Layout of High Voltage Laboratories: Introduction, Test Facilities provided in high voltage laboratories, Activities and studies in high voltage laboratories, Classification of high voltage laboratories, Size and Rating of large size high voltage laboratories, Grounding of impulse testing laboratories

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

1. gain skilful knowledge of controlling the electrical stress in electrical systems and proper use of electrical insulating media.
2. perform experiments on generation and measurement of high voltage and current
3. identify possible reasons for failure of electrical insulation
4. explore remedial measure for failure of electrical insulation.
5. design circuits for generation of high voltage and current, electrical insulation system and set up high voltage lab

Text Books:

1. High Voltage Engineering, MS Naidu and V. Kamaraju, TMH New Delhi.
2. High Voltage Engineering Fundamentals, E. Kuffel and WS Zaengl, Pergamon Press, Oxford.

Reference Books:

2. High Voltage Engineering, CL Wadhwa, New Age International (P) Limited, Publishers, New Delhi**.**
3. Electrical Breakdown of Gases, JM, Meek and JD, Crages, John Wiley, New York.

Course code: EE8217
Course title: EHV Power Transmission

Credit:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Mexwell's coefficients, Sequence inductance and capacitance, Charge Matrix, Effect of Ground wire.

MODULE – II

Surface Voltage-gradient on bundled conductors, Mangoldt's formula, Gradient factors & their use, Ground level electrostatic field of EHV lines.

MODULE – III

Power frequency over-voltage control, Series and shunt compensation, Generalised Constants of Compensated line, Static Var Compensators (SVC/SVS).

MODULE – IV

Switching over-voltages in EHV Systems

MODULE – V

Six-pulse Bridge Circuit: waveforms and relevant equations, Twelve-pulse converter, Advantages of higher pulse number, Bipolar to monopolar operation, Converter performance with phase control, Commutation and effect of reactance.

MODULE – VI

Introduction to HVDC Transmission system, Economical advantages, Technical advantages, Critical distance, Submarine transmission.

MODULE – VII

Inverter, Equivalent circuit of HVDC system, Schematic diagram, Reactive power consideration in HVDC system, Harmonics, Filters in HVDC system.

Text Books:

1. Extra High Voltage AC Transmission Engineering (2nd Ed.) by R.D. Begamudre, Wiley Eastern Ltd.

2. HVDC Power Transmission Systems by K. Padiyar, Wiley Eastern Ltd.

Reference Books:

1. EHV AC and HVDC Transmission Engineering and Practices by S.S. Rao, Khanna Publications.

Course code: EE8219
Course title: Fundamentals of Communication System

Credit:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Representation of Signals and Systems: Fourier series, Fourier Transform, Properties of Fourier Transform, Signal power and power spectral density, Signal energy and energy spectral density, Dirac delta function and its applications, Elements of a Communication system, Block diagram of digital communication system

MODULE – II

Amplitude Modulation Systems: Basics of Amplitude modulation, Square law modulator, Switching modulator Square law demodulator, Envelop Detector, Double side band suppressed carrier modulation. Balanced and Ring Modulators, Coherent modulator, Quadrature Amplitude Modulation.

MODULE – III

Amplitude Modulation Systems (Continued) : Single side band modulation, Frequency Discrimination and phase discrimination modulators, Coherent detection of SSB, Introduction to Frequency Division Multiplexing and Time Division Multiplexing, Superheterodyne AM receiver and its characteristics.

MODULE – IV

Angle Modulation Systems: Basic of Frequency and phase modulation, Single tone frequency modulation, NBFM, WBFM, Transmission bandwidth of FM wave, Indirect and Direct methods of FM generation, Frequency Discriminator, phase locked Loop demodulator, Super heterodyne F.M. receiver.

MODULE – V

Digital Modulation Techniques: Sampling Quantization, PCM, DPCM, DM, ADM

MODULE – VI

NOISE: Short Noise, Thermal noise, White Noise, Noise figure, Noise figure of an amplifier, Noise figure of amplifiers in cascade, Noise temperature, Noise Equivalent Bandwidth, Noise due to several amplifiers in cascade.

MODULE – VII

Digital Modulation Techniques: Binary modulation, generation and detection of binary modulated wave, DPSK, QPSK, Matched filter, satellite Communication System, Transponder.

Text Books:

1. Communication Systems", 2/e, S.Haykin.
2. Communication Systems", 2/e, B. P. Lathi, 1968.

Reference Book:

1. Communication Systems Engineering by John G. Proakis and Masoud Salehi, Pearson Education.
2. Principals of Communication Systems 2/e, by H. Taub and D L Schilling, Tata McGraw Hills New Delhi.
3. Communication Systems", 3/e, S. Haykin.

Course code: EE 8221

Course title: Utilisation of Electrical Power

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Pre-requisite(s): Knowledge of kinematics, Power electronics, physics, Boolean algebra and Computer programming.

Class schedule per week: 3 classes per week

Course Objectives:

This course enables the students :

1. To explain the requirements of ideal traction supply system, train movement and energy consumption and the various methods of speed control of traction motors.
2. To outline the knowledge of various methods of heating and welding and their applications.
3. To list the laws of illumination, sources of illumination, flood lighting and street lighting and outline the knowledge of components of PLC and PLC programming
4. Recall the knowledge of motor control circuits and their components, interlocking methods, different control methods and their applications.

Syllabus

MODULE – I : Electric Traction: Introduction, Requirements of Ideal Traction System Supply system for electric traction, Train movement Energy consumption. Co-efficient of adhesion, The
traction motors starting, Breaking of Traction motors.

MODULE – II : Speed Control of Traction Motor: Semiconductor converter controlled drives of Traction Motor, Chopper controlled DC traction motor drives. PWM Voltage source inverter (VSI) Induction motor drives, Load commutated inverter fed synchronous motor drivers, CSI squirrel Cage IM drive, PWM VSI Squirrel cage IM drive. Drives of Diesel Electric Traction Motors: Diesel Engine driven D.C Generator Feeding dc series motors. Diesel Engine driven three-phase alternator supplying dc motors.

MODULE – III: Heating & Welding: Introduction, Different methods of heating, Temperature control of resistance furnace, Induction heating, Dielectric heating, Electric welding, Different welding methods, current control of welding transformer, Ultrasonic and laser welding.

MODULE – IV: Illumination: Introduction, Nature of radiations, Definitions. Polar curve, Laws of Illumination, Luminous Efficacy, Source of light, Incandescent, Vapour, Flourescent Lighting calculations, Flood lighting, Street lighting.

MODULE – V: PLC: Introduction, Ladder diagram fundamentals of PLC: Introduction, Basic components and their symbol, Fundamentals of ladder diagram. PLC configurations. System Block Diagram, Update-solve the ladder Network.

MODULE – VI: Fundamental PLC Programming: Physical components Vs. Programme components, Internal Relays, Disagreement circuit. Ladder programme, Execution sequence, Flip-Flop circuits, Mnemonic programming code: AND ladder rung, Entering normally closed contracts, OR ladder rung, Simple branches, Complex branches.

MODULE – VII: Motor Control Circuit Components, Interlocking methods for reversing control, Sequence control, Schematic and wiring diagram for motor control circuits, Remote control operation of an IM, Motor driven pump for a water tank, automatic water level control, Sequence operation of motors with interlocking arrangements.

Course Outcomes:

After the completion of this course, students will be able to explain the concept of the following:

1. Duty cycle of a train.
2. speed control of traction motors.
3. Show a basic understanding of variety of tools and techniques (based on physics) used in heating, welding.
4. Design illumination schemes.
5. produce the knowledge of various methods of motor control and PLC programming.
6. Solve numerical problems on different engineering topics related to this subject.

Text Books:

1. Generation, Distribution and Utilisationof Electric Power, C. L. Wadhwa, Wiley – 1993.
2. Electrical Design and Estimating and Costing –K. B. Raina and S. K. Bhattacharya, Wiley – Delhi, 1993.
3. Fundamentals of Electrical Drives, G. K. Dubey, Narosa publication,New Delhi.
4. Programmable Logic Controllers, John R. Hackworth and Frederick D. Hackworth, Jr., Pearson Education – 2008.

Reference Books:

1. Utilisation of Electric Power, N. V. Suryanarayana, Wiley– 1994.
2. Utilisation of Electric Power – Taylor.

Course code: EE 8223
Course title: Artificial Intelligence

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I
Introduction: Basic definitions and concept of Artificial Intelligence (AI) – Representations in AI – Properties of Internal representation – The predicate calculus – Indexing, pointers, Alternative notations etc.

MODULE – II
Lisp Language: LISP style – Atoms and Lists-Building up Lisp structure – Basic LISP Primitives – Definitions, Predicates, Conditionals and Binding – The FOR function – Recursion and Iteration – Association lists, Properties and Data Abstraction – Definition Using Lambda – Scope of Variables – Printing and Reading – Input/ Output Optional. Parameters, Macros and Backquote – List storage, survey and reclamation, etc.

MODULE – III
Parsing Language: Rules of syntax – Syntactic parsing (Top – Down and Bottom – up parsing, Transition Network Parsers) – The Interpretation of Definite Noun phrases – Case grammer and meaning of verbs syntactic use of semantic knowledge- organization of operating, etc.

MODULE – IV
Search: Search problems – search tree with state evaluation numbers – A general purpose search algorithm – Depth first and breadth first search algorithms – Function as data in LISP.

MODULE – V
Logic and Deduction: Using predicate calculus – forward chaining and unification – Skolenization – Backward chairing – Nonmonotonic reasoning.

MODULE – VI
Memory Organization And Deduction: The importance of memory organization and approaches – Data Dependencies – Reasoning Involving Time – Spatial Reasoning – Rule Based Programming.

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MODULE – VII
Learning: Learning as Induction – Failure Driven Learning – Learning by being told.

Special Topics: Abduction and causation and evidence– Expert systems– AI and Robotics

Text Books:

1. Charnaik, Eugene and McDermott, Drew, “Introduction to Artificial Intelligence”, Addison-Wesley Publishing Co., Mento Park, California, U.S.A.
2. Winston, Patric Henry and Horn, Berthold K.P., “LISP”, Second Edition.
3. Artificial Intelligent System - Padhy, Oxford Publishers

Course code: MEE 2115
Course title: Embedded System and Applications

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Microcontrollers and their architecture: Introduction, general architecture of microcontrollers and microprocessors, types of microcontrollers, embedded processors. Overview of the 8051 family. 8051 architecture- memory organization, registers and I/O ports. Addressing modes , instruction sets, and assembly language programming. Introduction to C programming in 8051, Watchdog timer, Power down mode: idle/sleep mode.

MODULE – II

Interfacing: Programming timer/counter Interrupts- handling and programming. Serial communication using 8051-Interfacing with RS232. 8051 interfacing with keyboard, ADC, DAC, and LCD module interface. Application of microntroller for square wave and rectangular wave generation, frequency counter etc.

MODULE – III

Microcontroller RISC family-ARM processor fundamentals: Register Organisation, pipeline, core. ARM instruction sets: data processing, branch ,load-store, interrupts & program status register instructions. Exceptions & interrupts: handling & priorities. Development & Debugging tools for microcontroller based system design: software and hardware tools like {cross assembler, compiler, debugger, simulator, in-circuit emulator.

MODULE – IV

Embedded System Peripherals: Timers, Counters, example of reaction timer, UART, PWM generation, Controlling a dc motor using a PWM. General purpose processor, application specific instruction-set processor's (ASIP) and ASIC's, semiconductor IC's programmable logic device, Processor selection for embedded systems, special purpose processor.

MODULE – V

PIC microcontrollers: introduction, architecture (block diagram explanation only), and pin details of PIC 16F877 . Memory organization, ports and timers in PIC 16F877.

MODULE – VI

DSP based control of stepper motor: Basic operation of stepper motors, excitation tables of stepper motor, drive system of stepper motor, implementation of control logic using LF 2407 DSP, programming techniques for speed control of stepper motor.

MODULE – VII

DSP Based Control of BLDC Motor: Principle of BLDC motor, torque generation, BLDC motor control system, Implementation of BLDC motor control system using LF2407, subroutine for PWM generation and speed control of BLDC motor.

Text Books:

1. Muhammad Ali Mazidi, The 8051 microcontroller and Embedded System, 2006, Pearson Education.
2. PIC 16F877 data book
3. Hamid A. Toliyat, Steven Campbell-DSP-Based Electro-mechanical Motion Control, CRC Press
4. Andrew N Sloss,Dominic Symes,Chris Wright, ARM Developer's Guide, Elsevier

Reference Books:

1. ARM processor Data book
2. Kenneth Ayala, The 8051 Microcontroller, 3/ e, Thomson Publishing, New Delhi
3. David Seal,ARM Architecture Reference Manual
4. Wayne Wolf, Computers as Components: Principles of Embedded Computing system design, Else Vier, 2005

Course code: MEE 2101
Course title: Soft Computing Techniques

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

Module - 1

Introduction: Background, uncertainty and imprecision, statistics and random processes, uncertainty in Information. Fuzzy sets and membership, chance versus ambiguity, fuzzy control from an industrial perspective, Knowledge based systems for process control, knowledge based controllers, knowledge representation in knowledge based controllers. **Mathematics of Fuzzy Control:** Classical sets, Fuzzy sets, Properties of fuzzy sets, operations on fuzzy sets. Classical relations and fuzzy relations - cartesian product, crisp relation, Fuzzy relations, Tolerance and Equivalence Relations, Fuzzy tolerance and equivalence relations, operation on fuzzy relations, The extension principle.

Module - 2

Membership Function: Features of membership functions, standard forms and boundaries, Fuzzyification, Membership value assignment. **Fuzzy-to-Crisp Conversions:** Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations. Defuzzification Methods.

Module – 3

Introduction : Structure and foundation of Single Neuron, Neural Net Architectures, Neural Learning Application, Evaluation of Networks, Implementation. Supervised Learning - Single Layer Networks, Perceptions, Linear saparability, Perception, Training algorithms, Guarantee of success, Modifications.

Module - 4

Multilayer Networks: Multilevel discrimination, preliminaries, backpropagation algorithm, setting the parameter values, Accelerating the learning process, Applications, RBF Network.

Module - 5

Unsupervised Learnings: Winner take all networks, learning vector quantizers, ART, Topologically ortanised networks. **Associative Models**: Non-iterative procedures for Association, Hopfield networks.

Module - 6

Discussion of Neural Networks and Fuzzy Logic Application in areas of Power Electronics and motor control.

Text Books:

1. Fuzzy logic with Engineering Applications - Timothy J. Ross, McGraw-Hill International Editions.
2. Fuzzy Sets and Fuzzy logic: Theory and Applications - George J. Klir and Bo. Yuan, Prentice-Hall of India Private Limited.
3. Neural Networks: A Comprehensive Foundation - Siman Haykin, IEEE, Press, MacMillan, N.Y. 1994.

References Books:

1. Elements of Artificial Neural Networks - Kishan Mehrotra, Chilakuri K. Mohan, Sanjay Ranka (Penvam International Publishing (India)

Course code: MEE 2157
Course title: Renewable Sources of Electrical Energy

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

Module – I
Energy Scenario: Classification of Energy Sources, Energy resources (Conventional and nonconventional), Energy needs of India, and energy consumption patterns. Worldwide Potentials of these sources. Energy efficiency and energy security. Energy and its environmental impacts. Global environmental concern, Kyoto Protocol, Concept of Clean Development Mechanism (CDM) and Prototype Carbon Funds (PCF). Factors favoring and against renewable energy sources,IRP

Module – II
Solar Energy: Solar thermal Systems: Types of collectors, Collection systems, efficiency calculations, applications. Photo voltaic (PV) technology: Present status, - solar cells , cell technologies, characteristics of PV systems, equivalent circuit, array design , building integrated PV system, its components , sizing and economics. Peak power operation, Solar tracking system, Standalone and grid interactive systems.

Module – III
Wind Energy: Wind speed and power relation, power extracted from wind, wind distribution and wind speed predictions. Wind power systems: system components, Types of Turbine, Turbine rating Choice of generators, turbine rating, electrical load matching, Variable speed operation, maximum power operation, control systems, system design features, stand alone and grid connected operation.

Module – IV
Biomass Energy System: Biomass – various resources, energy contents, technological advancements, conversion of biomass in other form of energy – solid, liquid and gases. Gasifiers, Biomass fired boilers, Cofiring, Generation from municipal solid waste, Issues in harnessing these sources.

Module – V
Hydro energy: Feasibility of small, mini and micro hydel plants scheme layout economics. Tidal and wave energy, Geothermal and Ocean-thermal energy conversion (OTEC) systems – schemes, feasibility and viability.

Module – VI
Energy storage and hybrid system configurations: Energy storage: Battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators. Battery management. Fly wheel-energy relations, components, benefits over battery. Fuel Cell energy storage systems. Ultra Capacitors.

Module – VII
Grid Integration: Grid integration with the system: Interface requirements, Stable operation, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling.

Text Books:

1. Renewable energy technologies - R. Ramesh, Narosa Publication.
2. Energy Technology – S. Rao, Parulkar
3. Non-conventional Energy Systems – Mittal, Wheelers Publication.

Reference Books:

1. Wind and solar systems by Mukund Patel, CRC Press.
2. Solar Photovoltaics for terrestrials, Tapan Bhattacharya.
3. Wind Energy Technology – Njenkins, John Wiley & Sons
4. Solar & Wind energy Technologies – McNeils, Frenkel, Desai, Wiley Eastern.
5. Solar Energy – S.P. Sukhatme, Tata McGraw Hill.
6. Solar Energy – S. Bandopadhay, Universal Publishing.
7. Guide book for National Certification Examination for EM/EA – Book 1

Course code: EE 8225
Course title: Applied Control Theory

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Concepts of State, State Variables: Development of state-space models. State and state equations, State equations from transfer function Transfer function from state equations. State transition matrix, Solution of State equation, Transfer Matrix, State variables and linear discrete time systems.

MODULE – II

Controllability and Observability: Controllable and observable State models, Controllability and observability for discrete time systems.

MODULE – III

State Variable Feedback: Asymptotic state observers. Control system design via pole placement.

MODULE – IV

Optimal Control Systems: Introduction, Performance indices, Optimal control problems- Transfer function approach, State variable approach; Parameter optimization.

MODULE – V

Non-Linear Systems: Introduction. Common nonlinearities. Methods of studying non-linear systems: Linearization; Describing function analysis; Phase plane analysis.

MODULE – VI

Stability of Non-Linear Systems: Stability concepts. Stability analysis using Lyapunov's Direct method; Popov's stability criterion.

MODULE – VII

Adaptive Control Systems: Performance indices. Adaptive Controllers, Identification of dynamic characteristics of the plant

Text Books:

1. Digital Control & State Variable Methods – H. Gopal, Tata McGraw Hill.
2. Control Systems Engineering- I.J. Nagrath & M. Gopal.

Reference Books:

1. Modern Control System Theory- M. Gopal.
2. Modern Control Engineering- K. Ogata.
3. Control Systems- N. K. Sinha.

Course code: EE 8227
Course title: VLSI Design

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Circuits and System Representation: Behavioral, Structural and physical representation, Example of a triangular waveform generator and its behavioral, Structural and physical description.

MODULE – II

Basic CMOST Technology: Basic n-well CMOS Process, p-well process, Twin-tub process, Silicon on insulator, CMOS process enhancements, Metal interconnect, Polysilicon/refractory metal interconnect, Local interconnect, Circuit elements like resistors, Capacitors, EAROM, Bipolar transistors and thin film transistor.

MODULE – III

Layout Design Rules: Layer representations, CMOS n-well rules, Design rule backgrounder, Layer assignment, Latch-up problem, Latch-up triggering, Internal latch-up prevention techniques, Resistance estimation, Capacitance estimation.

MODULE – IV

Basic Physical Design of Simple Logic Gates: Investor, NAND and NOR gates, Complex logic gates layout, CMOS standard cell design, Gate array layout, Sea-of-gates layout, General CMOS logic gate layout guidelines, Layout optimization for performance, Transmission gate layout consideration, 2-input multiplexers, I/O structures, V_{oo} and V_{ss} pads, Output and input pads, Tristate and bi-directional pads, Miscellaneous pads.

MODULE – V

CMOS Analogue Design Method: Opamp design, Feedback and frequency compensation, Opamp as a comparator, Sample and hold, Analogue layout considerations, Transistor layouts, Centroid design, Capacitor matching, Resistor layout, Noise consideration.

MODULE – VI

CMOS Digital Design Methods: Structured design strategies, Hierarchy, Regularity, Modularity, Locality, Design options like PL, Reprogrammable gate arrays, XILINX PGA, Standard cell design, behavioural synthesis, RTL synthesis, Logic optimization, Structural to layout synthesis, Placement, Routing, Automatic placement example.

MODULE – VII

CMOS Subsystem Design: Single bit address, Bit parallel adder, Transmission gate adder, Asynchronous counter, Synbhg chronous counter, RM, Finite state machines, Multilevel logic.

Text Books:

1. Principle of CMOS VLSI Design A System Perspective, Weste Neil HE and Eshraghian K, Pearson Education, 1993.
2. Analog Integrated circuit Design – David Johns & Ken Martin, Wiley India.

Reference Books:

1. CMOS Circuit Design, Layout & Simulation – R. Jacob Baker, Harry W. Li & David E. Boyce, Prentice Hall of India Pvt. Ltd.
2. Design of Analog CMOS Integrated Circuits – Behzad Razavi, TMH Educat. Pvt. Ltd.
3. COMS Analog Circuit Design – Phillip E. Allen & Douglas R. Holbarg, Oxford University Press.
4. Basic VLSI Design – Douglas A. Pucknell, PHI.
5. Physics of Semiconductor Devices – Simon M. Sze, John Wiley & Sons.

Course code: EE 8229

Course title: Testing and Commissioning of Electrical Equipment

Credits:	**L**	**T**	**P**	**C**
	3	0	0	3

Syllabus:

MODULE – I

Transformers: Specification, Installation- Location and sites, Selection and design of foundation details (like bolts size, their number, etc.) code of practice for terminal plates, polarity and phase sequence, Oil tanks, drying of windings with & without oil, general inspection.

MODULE – II

Commissioning Test: Following tests as per national & International standards, Volt ratio test, Earth resistance oil strength, Bochholz & other relays, tap changing gear, Fans & pumps, Insulation test, impulse test, polarizing index, load & temperature raise test. Specific Test- Determination of performance curves like efficiency, regulation etc., Determination of mechanical stress under normal & abnormal conditions, Maintenance Schedule

MODULE – III

Induction Motors: Specifications for different types of motors, Duty, el L.P., protection. Installation- Location of the motors (including the foundation details) & its control apparatus, Shaft & alignment for various coupling, fitting of pulleys & couplings, Drying of windings

MODULE – IV

Commissioning Test: Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations & balancing. Electrical Tests - Insulation test, earth resistance, High voltage test, starting up failure to speed up to take the load type of test, routine test, factory test and site tests (in accordance with ISI code). Specific Tests : Performance & temperature rise tests, stray load losses, shaft elements, re-rating & special duty capability. Maintenance Schedule.

MODULE – V

Synchronous Machines: Specifications, Installation- Physical inspection, Rating nameplate details, Foundation details, Alignments, Excitation systems, Cooling & control gear, drying out. Commissioning Tests- Insulation, Resistance measurement of armature & field wings, Wave from & telephone interference factors, Line charging capacity.

MODULE –VI

Performance Tests: Various tests IP estimate the performance for generator & motor operations slip maximum lagging currents, Maximum reluctance power tests, Sudden short circuit tests, transient & sub transient parameters, measurements of sequence impedances, capacitive reactance, Separation of losses, temperature rise tests, Retadation tests. Factory Tests - Gap length, magnetic centrity balancing vibration, bearing performance

MODULE – VII

Switchgear & Protective Devices: Standards, types, Specification, Installation, Commissioning tests, Maintenance schedule, Type & routine tests.

Text Books:

1. S. Rao, Testing & Commissioning of electrical equipment, Khanna Publishers
2. B.V.S. Rao, Testing & Commission of electrical equipment

Reference Books:

1. Relevant Bureau of Indian Standards
2. Transformers - BHEL
3. J & P transformer Handbook
4. J & P Switch gear Hand Book

SESSIONAL / LABORATORY:

Course code: EE8202

Course title: Simulation Lab

Credits:	**L**	**T**	**P**	**C**
	0	0	3	2

Pre-requisite(s): Electrical Machines, Power System, Power Electronics, MATLAB

Class schedule per week: 3 classes per week

Course Objectives:
This course enables the students to:

1. understand system dynamics of machines, power electronics and power system;
2. observe speed control of DC motor, induction motors drives, BLDC motor and generator speed control for arresting the frequency of power system network;
3. discriminate and predict the change in dynamics owing to various disturbances;
4. design the proper controller and to evaluate the performance of controller.

List of Experiments:

1. Determine the step response of second order circuit and simulate it in MATLAB/SIMULINK.
2. Develop the transfer function model of a separately excited as well as unsaturated dc motor drive. Use the developed transfer function model to analyze the variation in armature current, back emf and motor speed for no load, half load and full load torque with the help of SIMULINK.
3. To model and simulate the given dc motor using PI controller.
4. To model and simulate open loop v/f(scalar) speed control of 3-phase induction motor drives.
5. Develop logic to generate switching pulse for 3-phase PMBLDC motor and observe waveform of phase variables and motor torque.
6. To develop a simulink model for 1-phase sinusoidal PWM implementing unipolar method for 1-phase inverter.
7. To develop a simulink model for 3-phase sinusoidal PWM implementing bipolar method for 3-phase voltage source inverter.
8. To design a simulink model for implementing a DC-DC boost converter.
9. To implement a PV solar panel module in MATLAB(SIMULINK) and study its PV and VI curve.
10. Design and implementation of MPPT algorithm for a standalone PV system.

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

1. visualise the importance of electrical machines, power system and use of power electronics to tackle the different problems;
2. devise different modelling techniques like transfer function and state variable in order to outline the behaviour of electrical systems;
3. justify the types of controller for closed loop control system;
4. understand, simulate and design of any electrical system beyond the topic covered in the simulation lab;
5. comprehend and rewrite technical observations referring the results.

Text Books:

1. P.S. Bimbhra, Generalised Theory of Electric Machines, 7th Edition, Delhi, 2010, Khanna Publications.

Reference Books:

1. B K Bose: Modern Power Electronics and A C Drives, 2001, Delhi, PHI.
2. G K Dubey, Fundamental of Electric Drives, 2nd Edition, PHI, Delhi.
3. C.M. Ong, Dynamic Simulation of Electric Machinery, PH, NJ.

Course code: EE8204

Course title: Comprehensive Viva

Pre-requisite(s): Knowledge of all the subjects related to electrical engineering

Course Objectives:

This course enables the students:

1. To enable the examiners to assess a candidate's knowledge in his or her field of learning.
2. To test a student's awareness of the latest developments and relate them to the knowledge acquired during the classroom teaching.
3. To be willing to adept changes as per the industrial requirement and always upgrade oneself.
4. To be able to apply the knowledge in practical field.

Syllabus

All subjects related to electrical engineering

Course Outcomes:

After the completion of this course, students will be:

1. Face any kind of viva-voce, interviews, aptitude tests, group discussion, etc.
2. Perform well in competitive exams.
3. Apply knowledge in building career in particular field.
4. Enhance communication skills and interactiveness.
5. Implement new ideas in particular field of learning.

Course code: EE8210

Course title: Major Project

Pre-requisite(s): Latest Software skills; Knowledge on all the subjects related to all branches of engineering

Course Objectives:

This course enables:

1. the examiners to assess a candidate's knowledge in his or her field of learning.
2. the students to test awareness of the latest developments and relate them to the knowledge acquired during the classroom teaching.
3. the students to apply the knowledge in practical field/design a prototype model for a particular application.

Course Outcomes:

After the completion of this course, students will be able to:

1. face any kind of viva-voce, interviews, aptitude tests, group discussion, competitive exams, etc.;
2. learn group living and work in a team;
3. enhance communication skills and interactiveness through presentations;
4. apply knowledge in building career in particular field;
5. implement new ideas in particular field of learning and design a prototype model for a particular application.