GURU KASHI UNIVERSITY

Bachelor of Technology in Electrical Engineering

Session : 2022-23

Department of Electrical Engineering

PROGRAMME LEARNING OUTCOMES

Program Learning Outcomes: After completion of the program, the students will be able:

1. To apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. To identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. To design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. To use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

5. To create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. To apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. To understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. To Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. To function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. To communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. To demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. To recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Structure

Semester: I						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE101	Basic Electrical Engineering	Core Course	3	1	0	4
BEE102	Physics – I (Waves and Optics and Introduction to Quantum Mechanics)	Core Course	3	1	0	4
BEE103	Mathematics – I (Calculus and Differential Equations)	Core Course	3	1	0	4
BEE104	Engineering Graphics & Drawing	Skill Based	1	0	4	3
BEE105	Physics – I (Waves and Optics and Introduction to Quantum Mechanics) Lab	Skill Based	0	0	2	1
BEE106	Basic Electrical Engineering Lab	Skill Based	0	0	2	1
BEE107	Basics of Computer Hardware and Networking	Ability Enhancement	0	0	2	1
Discipline Elective-I (Any one of the following)						
BEE108	Energy conservation and Practices	Discipline Elective-I	3	0	0	3
BEE109	Electrical Safety and Standards					
BEE110	Basics of Information Technology					
Total			**13**	**3**	**10**	**21**

Semester: II						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE201	Engineering Chemistry	Core Course	3	1	0	4
BEE202	Mathematics –II (Linear Algebra, Transform Calculus and Numerical Methods)	Core Course	3	1	0	4
BEE203	Programming for Problem Solving	Skill Based	3	0	0	3
BEE204	Communication Skills	Skill Based	3	0	0	3
BEE205	Manufacturing Practices	Skill Based	1	0	4	3
BEE206	Engineering Chemistry Lab	Skill Based	0	0	2	1
BEE207	Programming for Problem Solving Lab	Skill Based	0	0	2	1
BEE208	Communication Skills Lab	Skill Based	0	0	2	1
BEE209	Numerical Aptitude and Reasoning Ability	VAC	1	0	0	1
BEE210	Digital Marketing					
BEE211	Stress Management					
Discipline Elective-II (Any one of the following)						
BEE212	Object Oriented Programming Using C++	Discipline Elective-II	3	0	0	3
BEE213	Innovation and Entrepreneurship skills					
BEE214	Basics of Electrical Domestic Appliances					
Total			**17**	**2**	**10**	**24**

Semester: III						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE301	Electrical Circuit Analysis	Core Course	3	1	0	4
BEE302	Electrical Machines – I	Core Course	3	1	0	4
BEE303	Electrical and Electronic Measurements	Skill Based	2	1	0	3
BEE304	Electromagnetic Fields	Skill Based	2	1	0	3
BEE305	Basic Electronics	Skill Based	2	1	0	3
BEE306	Basic Electronics Lab	Skill Based	0	0	2	1
BEE307	Electrical and Electronic Measurements Lab	Skill Based	0	0	2	1
BEE308	Electrical Machines – I Lab	Skill Based	0	0	2	1
BEE309	*Summer/Institutional Training	Skill Based	NA	NA	NA	S/US
Discipline Elective-III (Any one of the following)						
BEE310	Electrical Materials	Discipline Elective-III	3	0	0	3
BEE311	Mechanical Measurements					
BEE312	High Voltage Engineering					
BEE399		MOOC	-	-	-	-
Total			**15**	**5**	**6**	**23**

* Students will undergo for Summer/Institutional Training after 2nd semester for 6 weeks and marks will be added in 3rd semester. However this subject is not applicable to LEET students.
*(S/US) Satisfactory/ Unsatisfactory

Semester: IV						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE401	Electrical Machines – II	Core Course	3	1	0	4
BEE402	Power Electronics	Core Course	3	1	0	4
BEE403	Digital Electronics	Skill Based	3	0	0	3
BEE404	Mathematics-III (Probability & Statistics)	Skill Based	2	1	0	3
BEE405	Digital Electronics Lab	Skill Based	0	0	2	1
BEE406	Electrical Machines – II Lab	Skill Based	0	0	2	1
BEE407	Power Electronics Lab	Skill Based	0	0	2	1
BEE408	Environmental Studies	Environmental Studies	2	0	0	2
BCS415	Basics of Management	Value Added Couse	2	0	0	2
Discipline Elective-IV (Any one of the following)						
BEE409	Utilization of Electrical Engineering	Discipline Elective-IV	3	0	0	3
BEE410	Power Quality and FACTS					
BEE411	Electronic Devices & circuits					
Open Elective Course						
XXXX		OEC				
Total			**18**	**3**	**6**	**26**
Open Elective-I (Any one of the following)						
BEE412	Industrial Safety and Environment	OEC	2	0	0	2

BEE413	Operating System					
BEE414	Essence of Indian Traditional Knowledge					

Semester: V						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE501	Power System -I (Apparatus and Modeling)	Core Course	3	1	0	4
BEE502	Control Systems	Core Course	3	1	0	4
BEE503	Microprocessors & its applications	Skill Based	3	0	0	3
BEE504	Wind and Solar Energy	Skill Based	3	0	0	3
BEE505	Power System -I Lab	Skill Based	0	0	2	1
BEE506	Control Systems Lab	Skill Based	0	0	2	1
BEE507	Microprocessors & its applications Lab	Skill Based	0	0	2	1
BEE508	Leadership and Personality Development	Ability Enhancement	2	0	0	2
Discipline Elective-V (Any one of the following)						
BEE509	Digital Control Systems	Discipline Elective-V	3	0	0	3
BEE510	Computer Networks					
BEE511	Digital Signal Processing					
BEE599		MOOC	-	-	-	-
Total			**17**	**2**	**6**	**22**

Semester: VI						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE601	Power Systems-II (Operation and Control)	Core Course	3	1	0	4
BEE602	Programmable Logic Controllers	Core Course	3	1	0	4
BEE603	Generation of Electrical Power	Skill Based	3	0	0	3
BEE604	Operation Research	Research	2	0	0	2
BEE605	Power Systems-II Lab	Skill Based	0	0	2	1
BEE606	Programmable Logic Controllers Lab	Skill Based	0	0	2	1
Discipline Elective-VI (Any one of the following)						
BEE607	Electric Drives	Discipline Elective-VI	3	0	0	3
BEE608	Sensors and Transducers					
BEE609	Data Structure					
Discipline Elective-VII (Any one of the following)						
BEE610	Electric and Hybrid Vehicles	Discipline Elective-VII	3	0	0	3
BEE611	Power Plant Engineering					
BEE612	Computer Aided Design					
Open Elective Course						
XXXX		OEC	2	0	0	2
Total			**19**	**2**	**4**	**23**
Open Elective Course (Any one of the following)						
BEE613	Total Quality Management	OEC	2	0	0	2
BEE614	Computer Architecture					

BEE615	Estimating & Costing					

Semester: VII						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE701	Computer Aided Power System Analysis	Core Course	3	0	0	3
BEE702	Power System Protection	Core Course	3	0	0	3
BEE703	Research Methodology	Research	3	0	0	3
BEE704	MATLAB	Skill Based	0	0	2	1
BEE705	Project	Research	0	0	2	1
BEE706	Industrial/Institutional Training*	Skill Based	NA	NA	NA	10
BEE799		MOOC	-	-	-	-
Total			**9**	**0**	**4**	**21**
* Students will undergo for industrial training after 6th semester for 45 days and marks will be added in 7th semester						

Semester: VIII						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BEE801	Internship Training	Research	NA	NA	NA	20

Total	**0**	**0**	**0**	**20**
Grand Total	**108**	**17**	**46**	**180**

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]

i. Surprise Test (Two best out of three) - (10 Marks)
ii. Term paper (10 Marks)
iii. Assignment(s) (10 Marks)
iv. Attendance (5 marks)

B. Mid Semester Test-1: [30 Marks]
C. MST-2: [20Marks]
D. End-Term Exam: [20 Marks]

SEMESTER-I

Course Title: BASIC ELECTRICAL ENGINEERING
Course Code: BEE101

L	T	P	Credits
3	1	0	4

Course Outcomes:

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

1. Discuss the DC and AC electrical circuit elements with RLC in detail.
2. Analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.
3. Analyze Single Phase AC Circuits and representation of alternating quantities and determining the power in these circuits.
4. Classify the different types of Electrical machines.
5. Understand the different type of electrical installation devices.

Course Content

UNIT-I **15 Hours**

DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II **15 Hours**

AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Transformers

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-III **15 Hours**

Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and

efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT-IV **15 Hours**

Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Text / References Books:

(i) Kothari, D. P. and Nagrath, I. J. (2010). Basic Electrical Engineering. Tata McGraw Hill.
(ii) Kulshreshtha, D. C. (2009). Basic Electrical Engineering. McGraw Hill.
(iii) Bobrow, L. S. (2011). Fundamentals of Electrical Engineering. Oxford University Press.
(iv) Hughes, E. (2010). Electrical and Electronics Technology. Pearson,

SEMESTER-I

Course Title: PHYSICS-I (Waves and Optics and Introduction to Quantum Mechanics) Course Code: BEE102	L	T	P	Credits
	3	1	0	4

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

1. Describe and discuss experiments in which light behaves as a wave phenomenon and how these experiments can be described mathematically.
2. Verify Schrödinger equation in one dimension, wave functions and probability density at a general level.
3. Explain how light is reflected and refracted when it passes between media with different refraction index.
4. Use the basic concepts and carry out calculations and solve theoretical problems in the part of waves, optics and quantum physics.
5. Carry out a simple analysis of experimental results and discuss the uncertainty and the reasonableness in the measured values.

Course Content

UNIT-I **15 Hours**

Waves

Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator

Non-dispersive transverse and longitudinal waves

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves.

UNIT-II **15 Hours**

Light and Optics

Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them.

Wave Optics

Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT-III **15 Hours**

Lasers

Einstein's theory of matter radiation interaction, A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity.

Introduction to Quantum Mechanics

Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

UNIT-IV **15 Hours**

Solution of Wave Equation

Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator. Scattering from a potential barrier and tunneling; related examples like alpha decay, field-ionization and scanning tunneling microscope, tunneling in semiconductor structures. Three-dimensional problems: particle in three dimensional box and related examples.

Introduction to Solids and Semiconductors

Free electron theory of metals, Fermi level, density of states in 1, 2 and 3 dimensions, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p -n junction.

Text / References Books:

1. I. G. Main, (1993) “Vibrations and waves in physics”, Cambridge University Press,.
2. H. J. Pain, (2006) “The physics of vibrations and waves”, Wiley.
3. E. Hecht, (2008) “Optics”, Pearson Education,.
4. A. Ghatak, (2012) “Optics”, McGraw Hill Education.
5. O. Svelto, (2010) “Principles of Lasers”, Springer Science & Business Media.
6. D. J. Griffiths, (2014) “Quantum mechanics”, Pearson Education.
7. R. Robinett, (2006) “Quantum Mechanics”, OUP Oxford.
8. D. McQuarrie, (2007) “Quantum Chemistry”, University Science Books.
9. D. A. Neamen, (1997) “Semiconductor Physics and Devices”, Times Mirror High Education Group, Chicago.
10. E.S. Yang, (1988) “Microelectronic Devices”, McGraw Hill, Singapore.
11. B.G. Streetman, (1995) “Solid State Electronic Devices”, Prentice Hall of India.

SEMESTER-I

Course Title: MATHEMATICS –I (Calculus and Differential Equations) Course Code: BEE103	L	T	P	Credits
	3	1	0	4

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

1. Demonstrate the fundamental theorem of calculus and use it for evaluating definite integrals and derivatives of integrals with variable limits of integration.
2. Distinguish between the concepts of sequence and series, and determine limits of sequences and convergence and approximate sums.
3. Analyze the methods of forming and solving Ordinary differential equations and Solve linear differential equations with constant and variable coefficients.
4. Explain the concept of differential equation and classifies the differential equations with respect to their order and linearity.
5. Set up and evaluate multiple integrals for regions in the plane to find area of the region bounded by curves and volume, surface area, Mass, C.G and M.I of solid geometric figures.

Course Content

UNIT-I **15 Hours**

Calculus

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle’s theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

UNIT-II **15 Hours**

Sequences and Series

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval’s theorem.

Multivariable Calculus: Differentiation

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

UNIT-III **15 Hours**

Multivariable Calculus: Integration

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

First Order Ordinary Differential Equations

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT-IV **15 Hours**

Ordinary Differential Equations of Higher Order

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Partial Differential Equations: First Order

First order partial differential equations, solutions of first order linear and non-linear PDEs.

Text / References:

1. Thomes, G.B.and Finney, R.L.(2010)Calculus and Analytic Geometry; Ninth Edition; Pearson Education
2. Kreyszig, E.(1998)Advanced Engineering Mathematics; Eighth Edition, John wiley and sons.
3. Grewal, B.S.(1965) Higher Engineering Mathematics ; Khanna Publishers, New Delhi.
4. Babu Ram (2009) Advance Engineering Mathematics; First Edition; Pearson Education.
5. Richard Courant and Fritz John (2012) Introduction to Calculus and Analysis,

Volume II , V Springer Publication

6. Harold M. Edwards (2013) Advanced Calculus: A Differential Forms Approach, Birkhauser.
7. Veerarajan, T. (2008). Engineering Mathematics for first year. Tata McGraw-Hill, New Delhi.
8. Ramana, B.V. (2010). Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint.
9. Poole, D. (2005). Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole.

SEMESTER-I

Course Title: ENGINEERING GRAPHICS & DRAWING
Course Code: BEE104

L	T	P	Credits
3	1	0	4

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

1. Understand about engineering drawing applications and its importance in society.
2. Learn about the visual aspects of engineering design.
3. Understand the engineering graphics standards.
4. Understand the concept of solid modeling techniques.
5. Apply the computer-aided geometric design in engineering.

Course Content

UNIT-I **15 Hours**

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales. Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

UNIT-II **15 Hours**

Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT-III **15 Hours**

Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Customization& CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-IV **15 Hours**

Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerance techniques; dimensioning and scale multi views of dwelling; Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerance; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath,

sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).

Text/References Books:

1. Gill, P.S.(2001).Engineering Drawing. S.K; Kataria and Sons, Ludhiana.
2. Bhatt, N.D.(2012).Engineering Drawing. Charotar Book Stall, Tulsi Sadan, Anand.
3. French, T.E. and Vierck. C.J.(1993).Graphic Science. McGraw-Hill, New York.
4. Zozzora, F.(1958).Engineering Drawing. McGraw Hill, New York.
(Corresponding set of) CAD Software Theory and User Manuals

SEMESTER-I

Course Title: PHYSICS-1 (Waves and Optics and Introduction to Quantum Mechanics) Lab
Course Code: BEE105

L	T	P	Credits
0	0	2	1

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

1. Carry out measurements and laboratory work in optics and spectroscopy.
2. Write an individual written report on the results of laboratory work and calculations.
3. Use the basic concepts and carry out calculations and solve theoretical problems in the part of waves, optics and quantum physics that the course contains.
4. Explain how physical models can be derived from basic principles and be tested by experimental measurements.
5. Determine the stopping potential from the photocurrent versus applied potential graph.

Course Content

15 Hours

List of experiments/demonstrations:

1. To study the laser beam characteristics like; wavelength using diffraction grating aperture & divergence.
2. Study of diffraction using laser beam and thus to determine the grating

element.

3. To study laser interference using Michelson's Interferometer.
4. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
5. To determine attenuation & propagation losses in optical fibres.
6. To determine the grain size of a material using optical microscope.
7. To find the refractive index of a material/glass using spectrometer.
8. To find the refractive index of a liquid using spectrometer.
9. To find the velocity of ultrasound in liquid.
10. To determine the specific rotation of sugar using Laurent's half-shade polar meter.
11. To find the resolving power of the prism.
12. To determine the angle of the given prism.
13. To determine the refractive index of the material of a prism.
14. To calculate the beam divergence and spot size of the given laser beam.
15. To determine the wavelength of a laser using the Michelson interferometer.
16. To revise the concept of interference of light waves in general and thin-film interference in particular.
17. To set up and observe Newton's rings.
18. To determine the wavelength of the given source.
19. To understand the phenomenon Photoelectric effect as a whole.
20. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
21. To determine the Planck's constant from kinetic energy versus frequency graph.
22. To plot a graph connecting photocurrent and applied potential.
23. To determine the stopping potential from the photocurrent versus applied potential graph.

SEMESTER-I

Course Title: BASIC ELECTRICAL ENGINEERING LAB
Course Code: BEE106

L	T	P	Credits
0	0	2	1

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

1. Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.
2. Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.
3. Analysis of Single Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
4. Categorize and compare different types of Electrical machines.
5. Classify different electrical measuring equipment's and understanding their principles.

Course Content

15 Hours

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase

currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.

5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

SEMESTER-I

Course Title: BASICS OF COMPUTER HARDWARE AND NETWORKING
Course Code: BEE107

L	T	P	Credits
0	0	2	1

Course Content

15 Hours

List of experiments/demonstrations:

1. Various Components of a Computer.
2. Introduction to Microsoft Word & Presentation
3. Make a simple presentation on your college.
4. Use 3D effects, on prescribed presentation.
5. Applications of Ms-Office Ms-Word.
6. Ms-Excel.
7. Ms-Power Point.
8. Create web pages for your college using different tags.
9. Web Browser and E- Mail.
10. Conversion of a word documents into PDF/ Image conversion using image file format.

SEMESTER-I

Course Title: ENERGY CONSERVATION AND PRACTICES
Course Code: BEE108

L	T	P	Credits
3	0	0	3

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

1. Acquire an in depth knowledge about the energy management and auditing
2. Recognize how energy can be conserved and managed in industries.
3. Acquire a comprehensive idea on tariffs in Transmission &Distribution systems.
4. Be conversant in utilization and effects of energy on Environment.
5. Be competent to handle the Energy auditing procedure.

Course Content

UNIT-I **10 Hours**

Basics of Energy Conservation

Need of energy conservation and energy audit; Energy Intensive processes, Heating: methods/Techniques of energy Saving in Furnaces, Ovens and Boilers; Cooling: Methods/ Techniques of Energy Saving in Ventilating systems and Air Conditioners; Lighting energy: methods/Techniques of efficient lighting; Cogeneration -Types and Advantages

UNIT-II **15 Hours**

Efficiency improvement in Motors

Losses in Electrical Machines, Methods to reduce these losses, Efficient use of energy in motors with the help of voltage reducers, automatic star/ delta converters; Energy Efficient Motors: Construction, operation and characteristics; Power factor improvement devices and soft starters/Variable Frequency Drives.

Energy Conservation in Transmission and Distribution(T&D) Systems

Reactive power compensation, demand side management, system voltage optimization and phase current balancing, Losses in transmission and distribution system and its minimization; Amorphous Core Transformers

UNIT-III **10 Hours**

Tariff and Energy Conservation in Industries

Energy cost and Recent Electricity Board tariffs, Application of Tariff System to reduce Energy bill, Energy Conservation by improving load factor and power factor.

Energy and the Environment

Environment and social concerns related to energy utilization, The green-house effect, Global Warming and its effect, Pollution, Acid Rains, Global Energy and environment Management.

UNIT-IV **10 Hours**

Energy Audit

Procedure of Energy audit, Selective Inventory Control analysis, Energy Flow Diagram and its importance, Measurements in energy audit and various measuring instruments, Questionnaires for the energy audit, internal energy audit checklist, Equipment used for energy conservation, Calculation of payback period for energy conservation equipment. IE rules and regulations for energy audit, Electricity act 2003

Text/Reference Books:

1. Bureau of Energy Efficiency, Bureau of Energy Efficiency Handbooks.
2. C.L.Wadhwa, Generation Distribution & Utilization of Electrical Energy, New Age international,1989
3. G Petrecca, Industrial Energy Management: Principles & applications, Kluwer Academic Publisher,1993

SEMESTER-I

Course Title: ELECTRICAL SAFETY AND STANDARDS
Course Code: BEE109

L	T	P	Credits
3	0	0	3

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

1. Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
2. Summarize the Safety aspects during Installation of Plant and Equipment.
3. Describe the electrical safety in residential, commercial and agricultural installations.
4. Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing.
5. State the electrical systems and IE rules.

Course Contents

UNIT-I **6 Hours**

Introduction To Electrical Safety, Shocks and Their Prevention
Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT-II **10 Hours**

Safety during Installation of Plant and Equipment
Introduction, preliminary preparations, preconditions for start of installation work, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III **8 Hours**

Electrical Safety in Residential, Commercial and Agricultural Installations

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT-IV **6 Hours**

Equipment Earthing and System Neutral Earthing

Introduction, Distinction between system grounding and equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of an earthing system, neutral grounding (System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

UNIT-V **8 Hours**

Review of IE Rules and Acts

Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and firefighting facility. Act, Safety Regulations and relevant Code and Standards: Electricity Act,2003 (Part 1, 2, 3, 4 & 5), Factories Act, 1948, CEA(Measures relating to Safety and Electric Supply), Regulations,2010, CEA(Technical Standards for Construction of Electrical Plants and Lines), Regulations,2010, CEA(Technical Standards for Connectivity to the Grid) Regulations, 2007, Relevant IS/NEC/IEC Standards mentioned in CEA Regulations or used in connection with generation, transmission, distribution of electricity, testing procedure, earthing of electrical apparatus and switchgears, fire safety, National Electrical Code, National Building Code, Hazardous area classification and classification of electrical equipments for hazardous areas (IS, NFPA, API and OSHA standards), all amendments in the Acts, Regulations, Code and Standards as mentioned above.

Text/Reference Books:

1. Pradeep Chaturvedi, “Energy management policy, planning and utilization”, Concept Publishing company, New Delhi, 1997.
2. S. Rao, Prof. H.L. Saluja, “Electrical safety, fire safety Engineering and safety management”, Khanna Publishers. New Delhi, 1988
3. Webster J.G and Albert M.Cook, Clinical Engg, Principles and Practices, Prentice Hall Inc., Engle wood Cliffs, New Jersy, 1979.
4. Karen Parsley, Karen Parsley Philomena Corrigan Quality improvement in Healthcare, 2nd edition, Nelson Thrones Pub, 2002.
5. Sharon Myers Patient Safety and Hospital Accreditation – A Model for Ensuring Success Springer Publishers 2012 7. Joseph F Dyro Clinical Engineering Handbook Elsevier Publishers, 2004.
6. www.apeasternpower.com/downloads/elecact2003.pdf

SEMESTER-I

Course Title: BASICS OF INFORMATION TECHNOLOGY
Course Code: BEE110

L	T	P	Credits
3	0	0	3

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

1. Define computer with his/he own sentences.
2. Aware themselves about basic of computer and its evolution.
3. Provide knowledge of different units of computer like processing unit, IO unit, and storage unit.
4. Operate windows OS and its features. • DOS OS and its internal and external commands.
5. To understand the computational problems, identify and abstract the programming task involved.

Course Content

UNIT-I

Information Technology – its concept and scope, applications of IT, impact of computer and IT in society. Computers for information storage, information seeking, information processing and information transmission

Computer Application in office, book publishing, data analysis, accounting, investment, inventory control, graphics, Air and Railway Ticket reservation, robotics, Military, banks, Insurance financial transactions and many more.

UNIT-II

Elements of computer system, computer hardware and software; data types – numeric data, alpha numeric data; contents of a program, processing. Computer organization, block diagram of a computer, CPU, memory

Input devices; keyboard, Scanner, mouse, etc. output devices; VDU and Printer, Plotter

Electrical requirements, inter-connections between units, connectors and cables

Secondary storage; magnetic disks – tracks and sectors, optical disk (CD, CD-RW and DVD), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus

UNIT-III

Basics of Networking – LAN, WAN, Topologies, Ethics and information Technology. Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file. Creating and operating on a folder. Changing setting like, date, time, colour (back ground and fore ground)

UNIT-IV

MS-Word: File Management: Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, Giving password protection for a file. Page Set up: Setting margins, tab setting, ruler, indenting.

SEMESTER-II

Course Title: ENGINEERING CHEMISTRY
Course Code: BEE201

L	T	P	Credits
3	1	0	4

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

1. Analyze microscopic chemistry in terms of atomic and molecular orbital's and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
4. Rationalize periodic properties such as ionization potential, electro negativity, Oxidation states and electro negativity.
5. To list major chemical reactions those are used in the synthesis of molecules.

Course Content

UNIT-I **15 Hours**

Atomic and molecular structure

Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and Nano particles, Forms of the hydrogen atom wave

functions and the plots of these functions to explore their spatial variations, Molecular orbital's of diatomic molecules and plots of the multicenter orbital. Equations for atomic and molecular orbital. Energy level diagrams of diatomic. Pi-molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT-II **15 Hours**

Spectroscopic techniques and applications

Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Diffraction and scattering.

Intermolecular forces and potential energy surfaces

Ionic, Dipolar and Vander Waals interactions, Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

UNIT-III **15 Hours**

Use of free energy in chemical Equilibria

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria, Water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

Periodic properties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

UNIT-IV **15 Hours**

Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Text/Reference Books:

i. Mahan, B. H. (1987). University chemistry.
ii. Sienko, M. J. & Plane, R. A. Chemistry. (1979): Principles and Applications. New York: McGraw-Hill.
iii. Banwell, C. N. (1966). Fundamentals of Molecular Spectroscop. New York, McGraw-Hill.
iv. Tembe, B. L., Kamaluddin & Krishnan, (2008). M. S. Engineering Chemistry (NPTEL Web-book).

SEMESTER-II

Course Title: MATHEMATICS –II (Linear Algebra, Transform Calculus and Numerical Methods)
Course Code: BEE202

L	T	P	Credits
3	1	0	4

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

1. Perform matrix operations and solve the matrix equation using elementary matrix operations.
2. Use systems of linear equations and matrix equations to determine linear dependency or independency, evaluate the eigen values and corresponding eigenvectors for a linear transformation.
3. Use various interpolation methods and finite difference concepts to find roots of polynomial equations using numerical analysis.
4. Explain how to interpolate the given set of values and the curve fitting for various polynomials.

5. Work numerically on the ordinary differential equations using different methods through the theory of finite differences and Runge - Kutta method.

Course Content

UNIT-I **15 Hours**

Matrices

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

UNIT-II **15 Hours**

Numerical Methods-I

Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

UNIT-III **15 Hours**

Numerical Methods-II

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

UNIT-IV **15 Hours**

Transform Calculus

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier transforms.

Text /References Books:

1 Gupta, S.K.(2009). Numerical Methods for Engineers (2nd Edition). New Age International Publishers.
2. Jain, M.K., Iyengar, S.R.K., &Jain, R.K. (2012).Numerical Methods for Scientific and Engineering Computation. New Age International.
3. Finlayson, B.A. (1980).Nonlinear Analysis in Chemical Engineering. MC Graw Hill
4. Villadsen, J. and Michelsen, M.L. (1978).Solution of Differential Equation Models by Polynomial Approximation. Prentice Hall.
5. Rice, R.G. & Do Duong, D. (1995).Applied Mathematics and Modelling for Chemical Engineers. John Wiley.
6. Sastry, S.S. (2005).Introductory Methods of Numerical Analysis (4th Edition). Prentice Hall of India.

SEMESTER-II

Course Title: PROGRAMMING FOR PROBLEM SOLVING
Course Code: BEE203

L	T	P	Credits
3	0	0	3

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

1. Design the algorithms to write a program.
2. Apply arrays, pointers and structures to formulate algorithms and programs.
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.
4. To implement conditional branching, iteration and recursion.
5. Test and execute the programs and correct syntax and logical errors.

Course Content

UNIT-I **15 Hours**

Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory Locations, Syntax and Logical Errors in compilation, object and executable code- Arithmetic expressions and precedence ,Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops

UNIT-II **10 Hours**

Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of Equations, notion of order of complexity through example programs (no formal definition required)

UNIT-III **10 Hours**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-IV **10 Hours**

Structure, Defining structures and Array of Structures, Pointers -Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation) File handling (only if time is available, otherwise should be done as part of the lab)

Text/Reference Books:

1. Byron Gottfried, Schaum's (1995), Outline of Programming with C, McGraw-Hill

2. E. Balaguruswamy (2005) Programming in ANSI C, Tata McGraw-Hill

SEMESTER-II

Course Title: COMMUNICATION SKILLS
Course Code: BEE204

L	T	P	Credits
3	0	0	3

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

1. Develop vocabulary and improve the accuracy in Grammar.
2. Apply the concepts of accurate English while writing and become equally ease at using good vocabulary and language skills.
3. Develop and Expand writing skills through Controlled and guided activities.
4. Compose articles and compositions in English.
5. Become autonomous and self-directed English language learners.

Course COntent

UNIT-I **8 Hours**

Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms and standard abbreviations.

UNIT-II **8 Hours**

Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.

UNIT-III **7 Hours**

Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Cliches.

UNIT-IV **7 Hours**

Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence. Writing introduction and conclusion.

Writing Practices

Comprehension, Précis Writing, Essay Writing

Text/Reference Books:

1. Swan, Michael. (1995). Practical English. OUP.
2. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
3. Zinsser, W. (2001). On Writing Well. Harper Resource Book.
4. Lyons, L. H. & Heasly, B. (2006). Study Writing. Cambridge University Press.
5. Kumar, S & Lata, P. (2011). Communication Skills. Oxford University Press.
6. CIEFL, Hyderabad. Exercises in Spoken English. Parts. I-III. Oxford University Press.

SEMESTER-II

Course Title: MANUFACTURING PRACTICES

Course Code: BEE205

L	T	P	Credits
1	0	4	3

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

1. Apply the various manufacturing methods in different fields of engineering.
2. Learn about the different fabrication techniques.
3. Learn about the practices in manufacturing of simple components using different materials.
4. Understand the advanced and latest manufacturing techniques being used in engineering industry.
5. Prepare different sand molds for various parts.

Course Content

UNIT-I **8 Hours**

Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

UNIT-II **6 Hours**

CNC machining, Additive manufacturing, Fitting operations & power tools

UNIT-III **6 Hours**

Electrical & Electronics Carpentry, Plastic moulding, glass cutting

UNIT-IV **10 Hours**

Metal casting, Welding (arc welding & gas welding), brazing [More hours can be given to Welding for Civil Engineering students as they may have to deal with Steel structures fabrication and erection; 3D Printing is an evolving manufacturing technology and merits some lectures and hands-on training.]

Workshop Practice:

1. Machine shop - 10 hours
2. Fitting shop - 8 hours
3. Carpentry - 6 hours
4. Electrical & Electronics - 8 hours
5. Welding shop - 8 hours (Arc welding 4 hrs + gas welding 4 hrs)

SEMESTER-II

Course Title: ENGINEERING CHEMISTRY LAB
Course Code: BEE206

L	T	P	Credits
0	0	2	1

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

1. Estimate rate constants of reactions from concentration of reactants/products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Apply the theoretical concepts for result analysis and interpret data obtained from experimentation.
4. Identify the compound using a combination of qualitative test and analytical methods.

Course Content

30 Hours

List of experiments/demonstrations:

Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction

15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscous meters to demonstrate of electric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

SEMESTER-II

Course Title: PROGRAMMING FOR PROBLEM SOLVING LAB
Course Code: BEE207

L	T	P	Credits
0	0	2	1

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

1. Create, read and write to and from simple text files.
2. Identify and correct logical errors encountered at run time.
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.
4. Represent data in arrays, strings and structures and manipulate them through a program.

Course Content

30 Hours

List of experiments/demonstrations:

Tutorial 1: Problem solving using computers
Lab1: Familiarization with programming Environment

Tutorial 2: Variable types and type conversions
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings, memory structure
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration)
Lab 8 and 9: Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling
Lab 12: File operations

Text/Reference Books:

1. Byron Gottfried, Schaum's (1995), Outline of Programming with C, McGraw-Hill
2. E. Balaguru swamy (2005) Programming in ANSI C, Tata McGraw-Hill.

SEMESTER-II

Course Title: COMMUNICATION SKILLS LAB
Course Code: BEE208

L	T	P	Credits
0	0	2	1

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

1. Illustrate the importance of pronunciation and apply the same day to day conversation
2. Apply verbal and non-verbal communication techniques in the Professional Environment.
3. Develop coherence, cohesion and competence in Oral discourse.
4. Handle the interview process confidently.
5. Communicate contextually in specific personal and professional situations with courtesy.

Course Content

15 Hours

Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

SEMESTER-II

Course Title: NUMERICAL APTITUDE & REASONING ABILITY
Course Code: BEE209

L	T	P	Credits
1	0	0	1

Course Outcomes: On successful completion of this course, students would be able to:

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Course Content

UNIT-I **4 Hours**

1. Quantitative Ability (Basic Mathematics)
1.1. Number Systems
1.2. LCM and HCF
1.3. Decimal Fractions
1.4. Simplification
1.5. Square Roots and Cube Roots
1.6. Average
1.7. Problems on Ages
1.8. Surds & Indices
1.9. Percentages
1.10 Problems on Numbers

UNIT-II **4 Hours**

2. Quantitative Ability (Applied & Engineering Mathematics)
2.1. Logarithm
2.2. Permutation and Combinations
2.3 Probability
2.4 Profit and Loss
2.5 Simple and Compound Interest
2.6. Time, Speed and Distance

2.7. Time & Work
2.8. Ratio and Proportion
2.9. Area
2.10 Mixtures and Allegation

UNIT-III **4 Hours**

3. Data Interpretation
3.1. Data Interpretation
3.2. Tables
3.3. Column Graphs
3.4. Bar Graphs
3.5. Line Charts
3.6. Pie Chart
3.7. Venn Diagrams

UNIT-IV **3 Hours**

4. Logical Reasoning (Deductive Reasoning)
4.1. Analogy
4.2. Blood Relation
4.3 Directional Sense
4.4. Number and Letter Series
4.5. Coding – Decoding
4.6. Calendars
4.7. Clocks
4.8. Venn Diagrams
4.9. Seating Arrangement
4.10. Syllogism
4.11. Mathematical Operations

Suggested Text / Reference Books

1. A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Analytical and Logical reasoning for CAT and other management entrance test By Sijwali B S
5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition

SEMESTER-II

Course Title: DIGITAL MARKETING
Course Code: BEE210

L	T	P	Cr.
1	0	0	1

Course Outcomes: To impart knowledge on executive skills, to get started in digital marketing, and managerial skills, that explains and prescribes how to make the most of your abilities. On successful completion of this course, students would be able to:

1. Use digital marketing to increase sales in today's business world.
2. Use Google AdWords and can optimize on-page / off-page.
3. Maintain a good social media strategy.
4. Understand web analytics to optimize your website for better traffic and revenue generation.
5. Grasp the concepts and become familiar management of e-commerce store, marketing and uploading of products on website.
6. Make WordPress account and create website.
7. Grasp the concepts and become familiar e-mail and affiliate marketing.

Course Content

UNIT-I **9 Hours**

Module 1: Introduction to Digital Marketing
Defining digital marketing, how is it different from traditional marketing and why is it relevant now?
Module 2: Search Engine Optimization (SEO) Techniques used to optimize any article, website, or blog for traffic & revenue generation.
Module 3: Social Media Marketing
Using different social media platforms (Facebook/Instagram/Twitter) to connect with the audience & convert them to a call of action (purchase or form filling).

UNIT-II **9 Hours**

Module 4: Search Engine Marketing
Techniques used to increase the visibility of your webpage on Google search results (SERP); Search engine marketing mostly revolves around paid search advertising (text-based ads that are visible on top of every search result).
Module 5: Web Analytics
Analyzing the behavior of visitors to a website through reports based on traffic source, referring sites, page views, and conversion rates of that website.
Module 6: E-Commerce Management

Maintenance of an online product-listing website through product keyword research, product pricing, positive reviews, and customer retention.

UNIT-III
Hours: 6

Module 7: Planning and Creating a Website
How to create a website on WordPress and later use website analytics to track the behavior of visitors to a website.
Module 8: Email Marketing
How to create and send product-based emails in bulk, and ensure that all of the emails have a good open rate and conversion rate.

UNIT-IV **6 Hours**

Module 9: Content Strategy
How to create content that matches the user intent and also your business goals.
Module 10: Affiliate Marketing
Generation of traffic via a third party (company/website). The third party is paid a commission fee to drive traffic to your website.

Suggested Text / Reference Books
1. Deiss, R. & Henneberry, R (2020). *Digital Marketing For Dummies, 1st edition*. Dummies.
2. Kingsnorth, S. (2019). *Digital Marketing Strategy – An Integrated Approach to Online Marketing, 2nd edition*. KoganPage.

SEMESTER-II

Course Title: STRESS MANAGEMENT
Course Code: BEE211

L	T	P	Credits
1	0	0	1

Course Outcomes: On successful completion of this course, students would be able to:

1. Identify the nature and causes of stress in organizations
2. Knowledge of stress prevention mechanism
3. Demonstrate the strategies that help cope with stress
4. Apply stress management principles in order to achieve high levels of performance
5. Adopt effective strategies, plans and techniques to deal with stress

UNIT-I **7 Hours**

1. Understanding Stress
1.1 Stress – concept, features, types of stress
1.2 Relation between Stressors and Stress
1.3 Potential Sources of Stress – Environmental, Organizational and Individual
1.4 Consequences of Stress – Physiological, Psychological and Behavioural Symptoms
1.5 Stress at work place – Meaning, Reasons
1.6 Impact of Stress on Performance
1.7 Work Stress Model
1.8 Burnout – Concept
1.9 Stress v/s Burnout

UNIT-II **8 Hours**

2. Managing Stress – I
2.1 Pre-requisites of Stress-free Life
2.2 Anxiety - Meaning, Mechanisms to cope up with anxiety
2.3 Relaxation - Concept and Techniques
2.4 Time Management - Meaning, Importance of Time Management
2.5 Approaches to Time Management
2.6 Stress Management - Concept, Benefits
2.7 Managing Stress at Individual level
2.8 Role of Organization in Managing Stress/ Stress Management Techniques
2.9 Approaches to Manage Stress - Action oriented, Emotion oriented, Acceptance oriented.

UNIT-III **7 Hours**

3. Managing Stress – II
3.1 Models of Stress Management - Transactional Model, Health Realization/ Innate Health Model
3.2 General Adaption Syndrome (GAS) - Concept, Stages
3.3 Measurement of Stress Reaction - The Physiological Response,
3.4 The Cognitive Response, The Behavioural Response.
3.5 Stress prevention mechanism - Stress management through mind control and purification theory and practice of yoga education.

3.6 Stress management interventions: primary, secondary, tertiary.
3.7 Meditation – Meaning, Importance

UNIT-IV **8 Hours**

4. Stress Management Leading to Success
4.1 Eustress – Concept, Factors affecting Eustress
4.2 Stress Management Therapy - Concept, Benefits
4.3 Stress Counselling - Concept
4.4 Value education for stress management
4.5 Stress and New Technology
4.6 Stress Audit Process
4.7 Assessment of Stress - Tools and Methods
4.8 Future of Stress Management

Suggested Text / Reference Books

1. Heena T. Bhagtani. (2018). Stress Management. Himalaya Publishing House.
2. Dutta, P,K, (2010) Stress Management. Himalaya Publishing House.
3. Roy,S (2012). Managing Stress. Sterling Publication.

SEMESTER-II

Course Title: Object Oriented Programming Using C++

Course Code: BEE212

L	T	P	Credits
3	0	0	3

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

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Illustrate dynamic memory management techniques using pointers, constructors, destructors, etc.
3. Construct the concept of function overloading, operator overloading, virtual functions and polymorphism
4. Classify inheritance with the understanding of early and late binding, usage of exception handling and generic programming.
5. Demonstrate the use of various OOPs concepts with the help of programs.

COURSE CONTENT

UNIT-I **15 Hours**

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

UNIT-II **15 Hours**

Standard Input/output: Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and member functions of i/o stream classes, formatting output, formatting using ions class functions and flags, formatting using manipulators.Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifies, and static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

UNIT-III **15 Hours**

Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and

dynamic),dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures. Constructors/Destructors and Operator Overloading and Type Conversion: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initialize lists. Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type

UNIT-IV **15 Hours**

Inheritance and Virtual functions & Polymorphism: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors. Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

Suggested Readings

1. Lafore R.(1992).*Object Oriented Programming in C++.* Waite Group.
2. Bjarne Stroustrup.(1985).*The C++ Programming Language*. Addison Wesley.
3. Herbert Schildt.(1994).*The Complete Reference to C++ Language.* McGraw Hill-Osborne.
4. Lippman F. B.*(*1997).*C++ Primer*. Addison Wesley.

SEMESTER-II

Course Title: INNOVATION AND ENTREPRENEURSHIP SKILLS
Course Code: BEE213

L	T	P	Credits
3	0	0	3

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

1. Explain the fundamentals behind the entrepreneurial personality and their intentions

2. Discover/create and evaluate opportunities.

3. Identify various stakeholders for the idea and develop value proposition for the same.

4. Describe various Business Models and design a business model canvas.

5. Analyse and select suitable finance and revenue models for start-up venture.

Course Content

UNIT-I **20 Hours**

Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions-characteristics, traits and behavioral; entrepreneurial challenges. **Entrepreneurial Opportunities:** Opportunities- discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.
Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation.

UNIT-II **15 Hours**

Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions - conventional industry logic, value innovation logic; customer focused innovation; building and analyzing business models; Business model canvas, Introduction to lean startups, Business Pitching.

UNIT-III **10 Hours**

Organizing Business and Entrepreneurial Finance: Forms of business organizations; organizational structures; Evolution of organization, sources and selection of venture finance options and its managerial implications. Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

Text/Reference Books:

1. Ries, Eric (2011), The lean Start-up: How constant innovation creates radically successful
businesses, Penguin Books Limited.
2. Blank, Steve (2013), The Startup Owner's Manual: The Step-by-Step Guide for Building a
Great Company, K&S Ranch.
3. S. Carter and D. Jones-Evans, Enterprise and small business- Principal Practice and Policy,
Pearson Education (2006)
4. T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw
Hill (2013)
5. Osterwalder, Alex and Pigneur, Yves (2010) Business Model Generation.
6. Kachru, Upendra, India Land of a Billion Entrepreneurs, Pearson
7. Bagchi, Subroto, (2008), Go Kiss the World: Life Lessons for the Young Professional, Portfolio Penguin
8. Bagchi, Subroto, (2012). MBA At 16: A Teenager's Guide to Business, Penguin Books

SEMESTER-II

Course Title: BASICS OF ELECTRICAL DOMESTIC APPLIANCES
Course Code: BEE214

L	T	P	Credits
3	0	0	3

Learning Outcomes: On successful completion of this course, the students will be able to:
1. Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protection devices.
2. Understand the working principles of different household domestic appliances.
3. Check the electrical connections at house-hold.
4. To learn the skills to repair the electrical appliances for the general troubleshooting and wiring faults.

Course Content

UNIT-I **6 Hours**

Basics of House wiring, Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances.

Co-curricular Activities (Hands on Exercises): **4 Hours**

[Any four of the following may be taken up]

1. Identifying Phase, Neutral and Earth on power sockets.

3. Identifying primary and secondary windings and measuring primary and secondary voltages in various types of transformers.

4. Observing the working of transformer under no-load and full load conditions.

5. Observing the connections of elements and identify current flow and voltage drops.

6. Studying electrical circuit protection using MCBs, ELCBs.

UNIT-II **10 Hours**

Electric Iron:

Type of Electric Iron – Ordinary type and automatic/Thermostat Control type/steam iron, Construction and working principle of electric irons; common defects, testing and repairs

Electric Stove:

Types of Electric Stoves- Coiled type, covered type, Hot Plate, Grill/Oven,

Cooking Range- Construction and working principle of electric stoves, common defects, testing and repairs; Induction heater; OTG and Microwave oven; Three phase heater, star and Delta connections.

Electric Toasters:

Types of Toasters - Ordinary and Automatic; Construction and working principles of electric toaster; common defects, testing and repairs.

UNIT-III **10 Hours**

Table Lamp and Tube Light:

Construction, working principles and use of Table Lamp, Night Lamp and Tube Light; Common faults, their causes, testing and repair, LED Table lamp.

Electric Fan:

Type of Fans – ceiling fan, Pedestal fan, Bracket Fan, Exhaust Fan; Construction working principles, special characteristics and applications of Electric fans; Common faults, their causes, testing and repairs; Installation of Bracket Fan and Exhaust Fan.

UNIT-IV **10 Hours**

Electric Mixer, Grinder and Blender:

Construction, working principles, special characteristics and applications of Electric Mixer, Grinder and Blender; Common Faults, their causes, testing and repairs; Servicing maintenance and overhauling of Electric Mixer, Grinder and Blender.

Emergency Light and Stabilizer:

Constructions and working principles of Emergency Light and Stabilizer; Common faults, their causes, testing and repairs.

Co-curricular Activities (Hands on Exercises): 10 Hours

1. Dismantling and reassemble of reflector type room Heater.
2. Dismantling and reassembling of Electric Iron (i) Ordinary type (ii) Automatic/Thermostat control type.
3. Testing and repair of Electric Iron (i) Ordinary type (ii) Automatic/Thermostat control type.
4. Dismantling and reassembling of Electric Stove (i) Coiled type (ii) Covered type

   (a) Hot plate (b) Grill (iii) Induction Heater (iv) Microwave oven, (v) Three phase heater star and delta connection
5. Connection of Fluorescent tube light (FTL) circuit.
6. Testing and repair of (i) Table Lamp (ii) Night Lamp and (ii) Tube Light (iv) LED table lamp
7. Testing fault finding, repair and overhauling of electric fans.
8. Testing fault finding, repair and overhauling of (i) electric mixer (ii) grinder (iii) blender.
9. Testing fault finding, repair and overhauling of emergency light
10. Testing fault finding, repair and overhauling of voltage stabilizer (manual and automatic)

Text/Reference Books:

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand& Co.,
2. A Text book on Electrical Technology, A.K.Theraja.
3. Performance and design of AC machines, M.G.Say, ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications.
5. Consumer Electronics, S.P.Bali, Pearson.
6. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications

SEMESTER-III

Course Title: ELECTRICAL CIRCUIT ANALYSIS
Course Code: BEE301

L	T	P	Credits
3	1	0	4

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

1. Understand the network theorems for the analysis of electrical circuits.
2. Obtain the transient and steady-state response of electrical circuits.
3. Analyze circuits in the sinusoidal steady-state (single-phase and three-phase). Analyze two port circuit behaviors.
4. Synthesize networks and filters.
5. To improve skills in network functions and two port network in electrical circuits

Course Content

UNIT-1 **15 Hours**

Basic Network Analysis

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks. Solution of first and second order differential equations for series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

UNIT-2 **15 Hours**

Electrical circuit and steady state analysis

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot convention in coupled circuits, Ideal Transformer. Analysis of electrical circuits using Laplace Transform for standard inputs, transformed network with

initial conditions. Frequency response (magnitude and phase plots), series and parallel resonances.

UNIT-3 **15 Hours**

Network functions and two port network

Driving point impedance and admittance, natural response of a network, transfer impedance and admittance, concept of pole and zeros in a network function, Routh Hurwitz criterion of stability.

Two Port Networks: terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

UNIT-4 **15 Hours**

Network Synthesis and Filters

Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Filters: Classification of filters, characteristics impedance and propagation constant of pure reactive network, ladder network, T-section, π-section, terminating half section, pass bands and stop bands, Design of constant-K, m-derived filters.

Text/Reference Books:

(i) Van Valkenburg, M. E. (2006). Network Analysis. Prentice Hall.
(ii) Choudhury, D. Roy. (1998). Networks and Systems. New Age International Publication.
(iii) Hayt W. H. and Kemmerl,y J. E. (2013). Engineering Circuit Analysis. McGraw Hill Education.
(iv) Alexander C. K. and Sadiku, M. N. O. (2004). Electric Circuits. McGraw Hill Education.

SEMESTER-III

Course Title: ELECTRICAL MACHINES-I
Course Code: BEE302

L	T	P	Credits
3	1	0	4

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

1. Discuss the concept of magnetic fields and magnetic circuits.
2. Understand the response of the dc machine on the basis of Armature Reaction and commutation.
3. Analyze the concept of starters and speed control of dc motors and evaluate the performance of dc machine by performing Swinburne' and Hopkinson's test.
4. Evaluate the performance of single-phase transformer by performing open circuit test, short circuit test and Sumpner's test.
5. Apply the suitable connection of 3 phase transformers in 3 phase systems and analyze the effect of harmonics in transformers.

Course Content

UNIT-I **15 Hours**

Magnetic fields and magnetic circuits

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

UNIT-II **15 Hours**

DC machines

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

of torque equation, armature reaction, air gap flux density distribution with armature reaction.

UNIT-III **15 Hours**

DC machine - motoring and generation

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

UNIT-IV **15 Hours**

Transformers

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

Text/Reference Books:

1. Fitzgerald E. and Kingsley, C. (2013). Electric Machinery. New York, McGraw Hill Education.
2. Clayton E. and Hancock, N. N. (2004). Performance and design of DC machines. CBS Publishers.
3. Say, M. G. (2002). Performance and design of AC machines. CBS Publishers.

Bimbhra, P. S. (2011). Electrical Machinery. Khanna Publishers.

SEMESTER-III

Course Title: ELECTRICAL AND ELECTRONIC MEASUREMENTS
Course Code: BEE303

L	T	P	Credits
2	1	0	3

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

1. Acquire knowledge of the characteristics of measuring instruments and their classification.
2. Be conversant in construction, working of measuring instruments and their proficient use.
3. Acquire knowledge various methods of electrical parameters measurement.
4. Be competent to handle various instruments for the measurement of electrical quantities.
5. Demonstrate Cathode Ray Oscilloscope (CRO) and recorders.

COURSE CONTENT

UNIT-1 **10 Hours**

Introduction
Functional Elements of generalized measurement system, Characteristics of instruments, errors in measurements and their statistical analysis: Limiting errors, combination of quantities with errors, types of errors.

Basic Indicating Instruments
Classification of analog instruments, concept of deflecting, controlling and damping torque, control and damping system, construction and principle of moving iron and moving coil instruments, construction of ammeter and voltmeter, Principles of operation Permanent Magnet Moving Coil (PMMC) ohm meters and their types.

UNIT-II **15 Hours**

Measurement of Resistance
Wheat stone bridge, Carey-Foster Bridge, Kelvin double bridge, Measurement of Insulation resistance.

AC bridges:

General equation for bridge balance, Measurement of Inductance (L), Capacitance (C), frequency (f) etc. by Maxwell Inductance Bridge, Hay's Bridge, De-Sauty's Bridge, Schering's bridge and Wein's bridge.

UNIT-III **5 Hours**

Instrument Transformers

Theory and construction of Current Transformer (CT) and Potential Transformer (PT), ratio and phase angle errors and their minimization, Characteristics of CT's. &PT's., Testing of CT's & PT's.

UNIT-IV **15 Hours**

Cathode ray Oscilloscope (CRO) and Recorders

Construction and working of cathode ray tube (CRT), Block diagram of CRO, measurement of voltage and frequency with CRO, basic CRO circuit, measurement of voltage, current, phase, frequency, time period. Dual track oscilloscope, specification of a cro and their significance, front panel controls. Study of various recorders

Text/Reference Books:

1. A.K. Sawhney and Puneet Sawhney, A course on electrical and electronic measurements and
   Instrumentation, Dhanpat Rai, 2012.
2. J.B Gupta, A Course in Electronic and Electrical Measurements & Instrumentation, S K Kataria and Sons, 1996.

SEMESTER-III

Course Title: ELECTROMAGNETIC FIELDS
Course Code: BEE304

L	T	P	Credits
2	1	0	3

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

1. Understand the basic mathematical concepts related to electromagnetic vector fields.
2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.
4. Understand the concepts related to Faraday‘s law, induced emf and Maxwell‘s equations.
5. Apply Maxwell‘s equations to solutions of problems relating to transmission lines and uniform plane wave propagation.

Course Content

UNIT-I **10 Hours**

Review of Vector Calculus

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

UNIT-II **10 Hours**

Static Electric Field

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

Energy density.Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

UNIT-III **10 Hours**

Magnetic Forces, and Inductance

Biot-Savart's law, Ampere's law of force, Ampere's circuital law, Faraday's law, Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, calculations of inductances and mutual inductances for a solenoid and toroid.

UNIT-IV **10 Hours**

Maxwell's Equations in Time Varying Fields and Wave theory

Concept of displacement current and conduction current, Maxwell's equation-differential and integral form, Poynting's theorem, its significance and Poynting's vector, Boundary Conditions. Wave theory: Derivation of wave equation, uniform plane waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Attenuation, phase and propagation constant, intrinsic impedance, Relation between E & H, wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect.

Text/Reference Books:

1. Edward C. Jordan and Keith G. Balmain, (2003) Electromagnetic Waves and Radiation System, Prentice Hall of India. Pvt. Ltd.
2. Kraus/ Fleisch,(1999) Electromagnetics, Tata McGraw Hill.
3. Fraser,W. (2003) Telecommunications, CBS Publication and Distributor.

SEMESTER-III

Course Title: BASIC ELECTRONICS
Course Code: BEE305

L	T	P	Credits
2	1	0	3

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

1. Discuss about electronics component and equipments like C.R.O., Function Generator and power supplies.
2. Analyze the V-I characteristics of PN-Junction diode and determine static resistance and dynamic resistance.
3. Describe the zener diode and study the characteristics of zener diode.
4. Design and plot the input and output characteristics of common emitter transistor and calculate its input and output resistance.
5. Classification of operational Amplifiers and Applications covering.

UNIT-I **10 Hours**

Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications.

UNIT-II **10 Hours**

Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;

UNIT-III **15 Hours**

Transistor Amplifiers and Oscillators covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle,

Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;

UNIT-IV **10 Hours**

Operational Amplifiers and Applications covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground;

Text/Reference Books:

1. David. A. Bell. (2003). Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.
2. L. Floyd and R. P. Jain (2009). Digital Fundamentals. Pearson Education.
3. Paul B. Zbar, A.P. Malvino and M.A. Miller. (2009). Basic Electronics – A Text-Lab. Manual, TMH.

SEMESTER-III

Course Title: BASIC ELECTRONICS LABORATORY
Course Code: BEE306

L	T	P	Credits
0	0	2	1

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

1. Discuss about electronics component and equipments like C.R.O., Function Generator and power supplies.
2. Analyze the V-I characteristics of PN-Junction diode and determine static resistance and dynamic resistance.
3. Describe the Zener diode and study the characteristics of Zener diode.
4. Design and plot the input and output characteristics of common emitter transistor and calculate its input and output resistance.
5. Analysis the truth tables of various basic digital gates.

Course Content

15 Hours

Laboratory Sessions covering

Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs); Identification, Specifications and Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs.

Study and Operation of Digital Multi Meter, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO

Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and Output Characteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration.

Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers,

Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop ICs; Functionality of Up-Down / Decade Counter ICs.

SEMESTER-III

Course Title: ELECTRICAL AND ELECTRONIC MEASUREMENTS LABORATORY
Course Code: BEE307

L	T	P	Credits
0	0	2	1

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

1. Design and validate DC and AC bridges.
2. Acquire knowledge of the characteristics of measuring instruments and their classification.
3. Acquire knowledge various methods of electrical parameters measurement.
4. Be competent to handle various instruments for the measurement of electrical quantities.
5. Demonstrate Cathode Ray Oscilloscope (CRO) and recorders

Course Content

15 Hours

LIST OF EXPERIMENTS:

1. To measure the unknown Inductance in terms of capacitance and resistance by using Maxwell's Inductance Bridge.
2. Measurement of resistance using Wheatstone bridge.
3. To measure unknown Inductance using Hay's bridge.
4. To measure unknown capacitance of small capacitors by using Schering's bridge.
5. To measure unknown capacitance using De-Sauty's bridge.
6. To measure unknown frequency using Wein's frequency bridge.
7. Measurement of capacitance using Schering Bridge.
8. To test the soil resistance using Meggar (Ohm meter).
9. To convert the Voltmeter into Ammeter using Potentiometer.
10. Determination of frequency and phase angle using CRO.

SEMESTER-III

Course Title: ELECTRICAL MACHINES - I LABORATORY

Course Code: BEE308

L	T	P	Credits
0	0	2	1

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

1. Understand the basic concept of single and three-phase transformer/system connections.
2. Evaluation of equivalent circuit parameters, efficiency and voltage regulation by performing various tests on transformer.
3. Analyze parallel operation of transformers.
4. Analyze performance characteristics of DC generators.
5. Evaluate the performance of starters and working in small projects.

Course Content

15 Hours

Hands-on experiments related to the course contents

Note: A student to perform any 8-10 Experiments and make one minor working model project.

Suggested List of Experiments:

1. To perform the load test on a single phase transformer.
2. To perform open circuit and short circuit tests on a single phase transformer and hence draw the equivalent circuit, calculate the voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of a three phase transformer.
6. To perform Scott connections on three phase transformer to get two phase supply.
7. To study the constructional details of DC machine and to draw sketches of different components.
8. To measure armature and field resistance of DC shunt generator and to

obtain its open circuit characteristics.

9. To obtain load characteristics of DC shunt/series/compound generator.
10. To draw speed-torque and torque-speed characteristics of DC shunt/series /compound generator.
11. To study the three point and four-point DC motor starters.
12. To perform Swinburne's test (no load test) to determine various losses of DC shunt motor.

SEMESTER-III

Course Title: ELECTRICAL MATERIALS
Course Code: BEE310

L	T	P	Credits
3	0	0	3

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

1. Review the fundamental concepts of materials into conducting, semi conducting and insulating materials
2. Apply preliminary cost estimating techniques to prepare building cost plans.
3. Apply estimating techniques to build unit prices.
4. Learn price conforming Tenders with available information.
5. Develop and apply appropriate cost planning bidding strategies that are ethically appropriate.

Course Content

UNIT-I **10 Hours**

Classification

Classifications of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands.

Conducting Material

Introduction, Resistance and factors affecting it such as alloying and temperature etc. Classification of conducting material as low resistivity and high resistivity materials, Low resistance materials; Copper: General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Applications in the field of electrical engineering; Aluminium: General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium, solder ability, contact resistance. Applications in the field of electrical engineering; Steel: General properties as conductor: Resistivity, corrosion, temperature coefficient, density, mechanical properties, solderability, Applications in the field of electrical engineering. Introduction to bundle conductors and its applications. Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), their practical applications with reasons for the same. Applications of special metals e.g. Silver, Gold, Platinum etc. High resistivity materials and their applications e.g., manganin, constantan, Nichrome, mercury, platinum, carbon and tungsten. Superconductors and their applications.

UNIT-II **10 Hours**

Review of Semi-conducting Materials Semi-conductors and their properties, Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.

Insulating materials; General Properties:

Electrical Properties: Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant

Physical Properties: Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness.

Thermal Properties: Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics

Chemical Properties: Solubility, chemical resistance, weatherability

Mechanical properties, mechanical structure, tensile structure

UNIT-III **10 Hours**

Insulating Materials and their applications:

Plastics: Definition and classification.

Thermosetting materials: Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea- formaldehyde and Malamine-formaldehyde), epoxy resins - their important properties and applications.

Thermo-plastic materials: Polyvinyl chloride (PVC), polyethelene, silicons, their important properties and applications.

Natural insulating materials, properties and their applications - Mica and Mica products, Asbestos and asbestos products. Ceramic materials (porcelain and steatite), Glass and glass products, Cotton, Silk, Jute, Paper (dry and impregnated), Rubber, Bitumen - Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation Enamels for winding wires Glass fibre sleeves.

Gaseous materials; Air, Hydrogen, Nitrogen, SF6 their properties and applications

UNIT-IV **15 Hours**

Magnetic Materials:

Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop including coercive force and residual magnetism,

concept of eddy current and hysteresis loss, curie temperature, magneto-striction effect.

Soft Magnetic Materials: Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines

Cold rolled grain-oriented steels for transformer, Non-oriented steels for rotating machine Nickel-iron alloys Soft Ferrites

Hard magnetic materials: Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications

Special Materials: Thermocouple, bimetals, leads soldering and fuses material, mention their applications. Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc

Text/Reference Books:

1. Electrical Engineering Materials Adrianus J Dekker, Phi Learning Publishers.
2. Electrical Properties of Materials, 8th Edition by Solymar, L, Oxford University Press New Delhi.
3. Introduction to Electrical Engineering Materials 4th Edn. 2004 Edition by Indulkar C, S.Chand & Company Ltd-New Delhi.
4. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi.

SEMESTER-III

Course Title: MECHANICAL MEASUREMENTS
Course Code: BEE311

L	T	P	Credits
3	0	0	3

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

1. Know the terms of the measurements, and understand the principle of operation of an instrument
2. Interpret characteristics of measuring instruments.
3. Apply methods of measurement for various physical quantities.
4. Apply the principles of miscellaneous measurements for humidity, density.

Course Content

UNIT-I **10 Hours**

Introduction

Measurement-definition-methods of measurement-Significance-Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration -Errors in Measurements-Systematic and Random error. Measuring instruments- Factors in selecting the measuring instruments

Pressure Measurements

Defining concept of atmospheric, absolute, vacuum, and gauge pressure; Units of pressure.

Manometers: Principle; types.
Elastic type: Bourdon tube; types, materials, construction; Metallic Diaphragm elements, construction; Capsule type; Bellows type
Electric methods of pressure measurements: Strain gauge pressure measurement, capacitance pressure measurement, potentiometric pressure measurements, optical pressure measurement
Special Pressure Measurement Techniques: Piston type pressure measurement; Pressure sensitive wire transducer, Dead Weight Piston Gauges.

UNIT-II **10 Hours**

Flow Measurement

Mechanical Flow Meters:

Orifice Flow Meter: Principle of operation; types of orifice plates; machining methods of orifice; material for orifice; position of tapes in orifice; Orifice Plate selection and Designing.
Venturi Tubes: Classical (long form) Venturi; Short form Venturi; Types of Venturi Tubes; Installation
Flow Nozzle: Flange type flow nozzle; Design of flow nozzle; applications

Electrical Flow Meters

Electromagnetic Flow Meter: Principle; Excitation schemes (AC, DC, and Dual Frequency);Construction.
Ultrasonic Flow Meter: Principle; Types of Ultrasonic Flow Meters; Construction; Doppler Flow Meters; Applications.

UNIT-III **5 Hours**

Level Measurements

Float Type Level Indications: Float level switch, Level measurement using float – rope method, float operated spring loaded level switch, magnetic float device. Level Measurement by Electrical Methods.

UNIT-IV **15 Hours**

Temperature Measurement

Thermistors: Theory; materials; types; and applications
Thermocouples: Theory; materials; types; and applications
Resistance Temperature Detector (RTD):
Temperature coefficient of resistivity of various metals; metals used in RTD; Platinum Resistance Thermometers.
Radiation Thermometers: Theory of black body radiation; realization of black body radiation.

Miscellaneous Measurements

Humidity measurement– construction, working of hair hygrometer.
Density measurement- Measurement of density using hydrometer.

Text/Reference Books:

1. A.K.Sawhney and Puneet Sawhney, “Mechanical Measurement and Instrumentation and Control”, 12th Edition, Dhanpat Rai & Co, 2009.

2. Instrument Engineers' Handbook: Process Measurement and Analysis B. G. Liptak.
3. Measurement Systems: Application and Design E. D. Doeblin, - McGraw – Hill Publication.
4. Industrial Instrumentation K. Krishnaswamy and S. Vijayachitra - New Age International Publications.

SEMESTER-III

Course Title: HIGH VOLTAGE ENGINEERING
Course Code: BEE312

L	T	P	Credits
3	0	0	3

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

1. Conceptualize the idea of high voltage and safety measures involved.
2. Analyse the breakdown mechanism of solids, liquids and gases.
3. Calculate the circuit parameters involved in generation of high voltages.
4. Measure direct, alternating and impulse high voltage signals.
5. Measure the dielectric loss and partial discharge involved in non-destructive high voltage tests.

Course Content

UNIT-I **15 Hours**

Introduction: Introduction to AC and DC impulse voltages and their use, Problems in dealing with high voltages.
Breakdown in Gases: Elementary ideas on ionization by electron collision, Townsend mechanism, Townsend first and second ionization coefficients, Paschen law, breakdown in non-uniform fields and corona discharges, vacuum breakdown mechanisms, breakdown in liquids, fundamentals of insulating oils, conduction and breakdown in pure and commercial liquids.
Breakdown in Solids: Fundamentals of solid insulating materials intrinsic, electromechanical and thermal breakdown, breakdown in simple and composite dielectrics, types of insulating materials, temperature classification, factor affecting dielectric strength, insulation design of rotating machines, transformers, transmission lines, Switch gear, etc.

UNIT-II **10 Hours**

Generation of High Voltages: Generation of high voltages, testing transformers in cascade, series resonant circuits and their advantages, half and full wave rectifier circuits, voltage doubler and cascade circuits, electrostatic generator,

characteristics parameters of impulse voltages, single stage impulse generator circuits, multistage impulse generation circuits.

UNIT-III **6 Hours**

Measurement of High Voltages: Measurement of direct, alternating and impulse voltages by electrostatic voltmeters, sphere gap, uniform field gap, ammeter in series with high voltage resistors and voltage divider.

UNIT-IV **6 Hours**

Non-Destructive High Voltage Tests: Loss in a dielectric and its measurement, dielectric loss measurement by Schering bridge, partial discharges at alternating voltages, external and internal partial discharges and discharge measurements.

Text/Reference Books:

1. Khalifa, M., High Voltage Engineering: Theory and Practice, Marcel Dekker Inc. (2000).
2. Naidu, M.S. and Kamraju, V., High Voltage Engineering, Tata McGraw−Hill (2008).
3. Wadhwa, C .L., High Voltage Engineering, New Age International (P) Limited, Publishers (2006).
4. Dass, R., Extra High Voltages, Tata McGraw−Hill (2006).
5. Kind, D. and Feser, K, High Voltage Test Techniques, Reed Educational and Professional Publishing Limited (2001).

SEMESTER-IV

Course Title: ELECTRICAL MACHINES – II
Course Code: BEE401

L	T	P	Credits
3	1	0	4

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

1. Understand the concepts of rotating magnetic fields.
2. Describe the operation of AC machines.
3. Analyze performance characteristics of AC machines.
4. To understand the difference between the synchronous machines and asynchronous machines.
5. Be able to understand equivalents circuits and phasor of induction machines.

Course Content

UNIT-I **15 Hours**

Fundamentals of AC machine windings

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

UNIT-II **15 Hours**

Pulsating and revolving magnetic fields

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

UNIT-III **15 Hours**

Induction Machines

Concept of rotating magnetic field, Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and maximum torque, power flow diagram, Equivalent circuit. Phasor diagram, Losses and efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-fed induction machines.

Single phase induction motors: Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications.

UNIT-IV **15 Hours**

Synchronous machines

Constructional features, cylindrical rotor and salient pole synchronous machine - generated EMF, coil span and distribution factor, equivalent circuit and phasor diagram, armature reaction at different power factor loads, voltage regulation by synchronous impedance and zero power factor method, concept of short circuit ratio, Operating characteristics of synchronous machines, V- curves and inverter-V curves. Hunting. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Text/Reference Books:

1. Fitzgerald A. E. and Kingsley C.(2013) Electric Machinery Mcgraw Hill Education
2. Alexander S. Langsdorf, (1955) Theory Of A.C. Machines, Mcgraw Hill Education

SEMESTER-IV

Course Title: POWER ELECTRONICS
Course Code: BEE402

L	T	P	Credits
3	1	0	4

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

1. Understand the differences between signal level and power level devices.
2. Analyse controlled rectifier circuits
3. Evaluate the operation of DC-DC choppers.
4. Analyses the operation of voltage source inverters.
5. Be able to understand Diode, Thyristor, MOSFET, IGBT and V-I characteristics.

Course Content

UNIT-I **15 Hours**

Power switching devices

Diode, Thyristor, MOSFET, IGBT: V-I characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT-II **15 Hours**

Thyristor rectifiers

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

UNIT-III **15 Hours**

DC-DC buck converter

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. DC-DC boost converter: Power

circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

UNIT-IV **15 Hours**

Single-phase voltage source inverter

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage. Three-phase voltage source inverter: Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation.

Text/Reference Books:

1. Reddi S R,(2002) Fundamentals of Power Electronics, Narosa Publishing House Pvt. Ltd, New Delhi
2. Mohammad H.(2005) Power Electronics, Circuits Devices and Applications Khanna Publishers, New Delhi
3. Bhattacharya S.K.(1998), Industrial Electronics & Control New Age international Publications(P) Ltd, New Delhi.

SEMESTER-IV

Course Title: DIGITAL ELECTRONICS
Course Code: BEE403

L	T	P	Credits
3	0	0	3

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

1. Discuss the basic fundamental of digital system and logic families
2. Realize working of logic families and logic gates.
3. Design and implement Combinational and Sequential logic circuits
4. Compute the process of Analog to Digital conversion and Digital to Analog conversion.
5. Be able to understand memories.

Course Content

UNIT-I **5 Hours**

Fundamentals of Digital Systems and logic families

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

UNIT-II **10 Hours**

Combinational Digital Circuits

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

UNIT-III **15 Hours**

Sequential circuits and systems

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

UNIT-IV **15 Hours**

A/D and D/A Converters

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

Text/Reference Books:

1. Malvino, (1998) Digital principle and applications, (TMH)
2. Jain, R. P.(2002) Modern digital electronics, (PHI)
3. Mano, M.M. (2001) Digital Design , (PHI)

SEMESTER-IV

Course Title: MATHEMATICS-III (Probability and Statistics)
Course Code: BEE404

L	T	P	Credits
2	1	0	3

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

1. Have basics knowledge about measure of central tendency, skewness, kurtosis and moments and their applications in engineering fields.
2. Familiarize the student with expectations of discrete and continuous random variable.
3. Familiarize probability techniques and random variables and detailed knowledge of probability distribution with so as to use it with any date of engineering problem formulation.
4. Have basic idea about statistics including correlation, regression and then up to advanced level with testing of large samples that is important in solving problems related to engineering.
5. To fit the given data into curves by various methods which forms an important application in engineering

Course Content

UNIT-I **10 Hours**

Measures of Central tendency: Moments, skewness and Kurtosis, Variance, Probability, conditional probability, Discrete and Continuous random variables, Expectations of Discrete and Continuous random variables.

UNIT-II **15 Hours**

Probability distributions: Binomial, Poisson and normal, Poisson approximation to the binomial distribution, evaluation of statistical parameters for these three distribution, bivariate distributions and their properties.

UNIT-III **10 Hours**

Correlation and regression for bivariate data, Rank correlation, Curve fitting by the method of least square, fitting of straight lines , second degree parabolas and more general curve.

UNIT-IV **10 Hours**

Test of significances: Sampling and standard error, Tests of significance for large samples and small samples (t-distribution, F-distribution), Chi-square test for goodness of fit and independence of attributes.

Text/Reference Books:

1. Thomes, G. B. & Finney, R.L. (1998). Calculus and Analytic Geometry. Addison Wesley.
2. Kreyszig, E. (1998). Advanced Engineering Mathematics. Eighth edition, John Wiley.
3. Grewal, B.S. (1965). Higher Engineering Mathematics. Khanna Publishers, New Delhi.
4. Babu, R. (2009).Advance engineering Mathematics. Pearson Education.

SEMESTER-IV

Course Title: DIGITAL ELECTRONICS LABORATORY
Course Code: BEE405

L	T	P	Credits
0	0	2	1

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

1. Understand of basic electronic components and circuits.
2. Verify truth tables of TTL gates.
3. Design and fabrication and realization of all gates and basic circuits.
4. Design the truth tables and basic circuits.
5. Testing of basic electronics circuits.

Course Content

15 Hours

Hands-on experiments related to the course contents

Note: A student to perform any 8-10 Experiments and make one working minor project.

Suggested List of Experiments:

1. Design a delay circuit using 555 timer and study the monostable, bistable and astable operations using 555.
2. Verification of the truth tables of TTL gates viz; 7400, 7402, 7404,7408,7432,7486.
3. Design and fabrication and realization of all gates using NAND/NOR gates.
4. Verification of truth table of Mutiplexer (74150)/Demultiplexer (74154)
5. Design and verification of truth tables of half-adder, full-adder and subtractor circuits using gates 7483 and 7486(controlled inverter).
6. To study the operation of Arithmetic Logic Unit IC 74181.
7. Design and test S-R flip-flop using NOR/NAND gates.
8. Design, fabricate and test a switch debouncer using 7400.
9. Verify the truth table of a JK flip flop using IC 7476,
10. Verify the truth table of a D flip flop using IC 7474 and study its operation in the toggle and asynchronous mode.
11. Operate the counters 7490, 7493 and 74193(Up/Down counting mode). Verify the frequency division at each stage. Using a frequency clock (say 1 Hz) display the count of LED's.
12. Verify the truth table of decoder driver7447/7448. Hence operate a 7

segment LED display through a counter using a low frequency clock. Repeat the above with the BCD to Decimal decoder 7442.

SEMESTER-IV

Course Title: ELECTRICAL MACHINES-II LABORATORY
Course Code: BEE406

L	T	P	Credits
0	0	2	1

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

1. Construct equivalent circuit's induction motors by routine tests.
2. Comprehend the requirement of starting and speed control methods of induction motors in the various applications of industry.
3. Construct equivalent circuits of synchronous generator and motor.
4. Apply knowledge to show utility of alternator, synchronous motors and synchronous condenser for various applications in power system.
5. Construct characteristic curves for induction and synchronous machines

Course Content

15 Hours

Hands-on experiments related to the course contents

Note: A student to perform any 8-10 Experiments and make one hardware/software based minor project.

Suggested List of Experiments:

1. To perform load-test on three-phase Induction motor and to plot torque versus speed characteristics.
   a) To perform no-load and blocked–rotor tests on three-phase Induction motor to obtain equivalent circuit.
2. To study the speed control of three-phase Induction motor by Kramer's Concept.
3. To study the speed control of three-phase Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.
4. To study star- delta starters physically and
   a) to draw electrical connection diagram
   b) to start the three-phase Induction motor using it.
   c) to reverse the direction of three-phase Induction motor
5. To start a three-phase slip –ring induction motor by inserting different levels of resistance in the rotor circuit and plot torque –speed

characteristics.

6. To perform no-load and blocked–rotor test on single-phase Induction motor and to determine the parameters of equivalent circuit drawn on the basis of double revolving field theory.
7. To perform no load and short circuit. Test on three-phase alternator and draw open and short circuit characteristics.
8. To find voltage regulation of an alternator by zero power factor (ZPF.) method.
9. To study effect of variation of field current upon the stator current and power factor with synchronous motor running at no load and draw Voltage and inverted Voltage curves of motor.
10. Parallel operation of three phase alternators using
    (i) Dark lamp method (ii) Two-Bright and one dark lamp method
11. To study synchroscope physically and parallel operation of three-phase alternators using synchroscope.
12. Starting of synchronous motors using:
    (i) Auxiliary motor (ii) Using Damper windings

SEMESTER-IV

L	T	P	Credits
0	0	0	2

Course Title: POWER ELECTRONICS LABORATORY
Course Code: BEE407

Course Outcomes:

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

1. Understand the properties and characteristics of thyristors.
2. Understand the different types of waveforms of inverter and chopper circuits.
3. Analyze speed and direction control of single phase and three phase electric motors using ac and dc drive.
4. Understand the effect of free-wheeling diode on pf with RL load.
5. Check the performance of a choppers, and inverter.

Hands-on experiments related to the course contents.

Note: A student to perform any 8-10 Experiments and make one hardware/software based minor project.

Suggested List of Experiments:

1. To plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
3. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
4. Study of the microprocessor-based firing control of a bridge converter.
5. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
6. To study Jones chopper or any chopper circuit to check the performance.
7. Thyristorised speed control of a D.C. Motor.
8. Speed Control of induction motor using thyristors.
9. Study of series inverter circuit and to check its performance.
10. Study of a single-phase cycloconverter.
11. To check the performance of a McMurray half-bridge inverter.

SEMESTER-IV

Course Title: ENVIRONMENTAL STUDIES
Course Code: BEE408

L	T	P	Credits
2	0	0	2

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

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Estimate the population - economic growth, energy requirement and demand
3. Analyze material balance for different environmental systems.
4. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
5. Identify the major pollutants and abatement devices for environmental management and sustainable development

Course Content

UNIT-I **5 Hours**

Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

UNIT-II **10 Hours**

Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management :Floods, earthquake, cyclone and landslides.

UNIT-III **10 Hours**

Social Issues and the Environment From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

UNIT-IV **5 Hours**

Human Population and the Environment, Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies.

Text/Reference Books:

1. Agarwal, K. C.(1998) Environment Biology, Nidi Publ. Ltd. Bikaner.

2. Jadhav, H & Bhosale, V.M. (2001) Environment Protection and Laws. Himalaya Pub House, Delhi

3. Rao M. N. & Datta A.K.(1997) Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.

SEMESTER-IV

Course Title: UTILIZATION OF ELECTRICAL ENGINEERING
Course Code: BEE409

L	T	P	Credits
3	0	0	3

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

1. Understand basic principles of electric heating and welding.
2. Determine the lighting requirements for flood lighting, household and industrial needs.
3. Calculate heat developed in induction furnace.
4. Evaluate speed time curves for traction.
5. Determine the Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants.

Course Content

UNIT-I **10 Hours**

Electric Drives

Advantages of electric drives, Characteristics of different mechanical loads, Parts of electric drives electric motors, close loop of electric drive system, Types of motors used in electric drive pulley drives etc., Examples of selection of motors for different types of domestic loads, Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc.

UNIT-II **10 Hours**

Illumination

Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light, Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux, Laws of illumination, Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapour lamp, fluorescent lamp, metal halide lamp, neon lamp, Main requirements of proper lighting; absence of glare, contrast and shadow, General ideas bout street

lighting, flood lighting, monument lighting and decorative lighting, light characteristics etc

UNIT-III **15 Hours**

Electric Heating

Advantages of electrical heating, Heating methods: Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances and thermostat control circuit, Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace.

Electric Welding:
Advantages of electric welding, Welding method, Principles of resistance welding, types, Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method of and their applications.

UNIT-IV **10 Hours**

Electrical Circuits used in Refrigeration and Air Conditioning and Water Coolers:
Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly Refrigerants, Electrolytic Processes, Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing.

Text/Reference Books:

1. Partap, H. (1999). Art and Science of Utilization of Electrical Energy. Dhanpat Rai & Sons, Delhi.
2. Gupta, JB. (1998). Utilization of Electrical Energy. Kataria Publications, Ludhiana.
3. Sahdev. (2003). Utilization of Electrical Energy. Uneek Publication, Jalandhar.
4. E.O.Taylor (2005) Utilization of electrical energy.
5. VedamSubrahmanyam(2008) Electrical Drives: Concept and applications. THM

SEMESTER-IV

Course Title: POWER QUALITY AND FACTS
Course Code: BEE410

L	T	P	Credits
3	0	0	3

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

1. Understand the differences between Shunt and series compensation.
2. Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
3. Understand the working principles of FACTS devices and their operating characteristics.
4. Understand the basic concepts of power quality
5. Understand the working principles of devices to improve power quality

Course Content

UNIT-I **10 Hours**

Transmission Lines and Series/Shunt Reactive Power Compensation

Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

UNIT-II **15 Hours**

Thyristor-based Flexible AC Transmission Controllers (FACTS)

Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Voltage Source Converter based (FACTS) controllers

Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination,

Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

UNIT-III **10 Hours**

Application of FACTS

Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.

Power Quality Problems in Distribution Systems

Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve.

UNIT-IV **10 Hours**

DSTATCOM

Reactive power compensation, harmonics and unbalance mitigation in distribution systems using DSTATCOM and shunt active filters. Synchronous reference frame extraction of reference currents. Current control techniques for DSTATCOM.

Dynamic Voltage Restorer and Unified Power Quality Conditioner

Voltage sag/swell mitigation: dynamic voltage restorer – working principle and control strategies. Series active filtering. Unified power quality conditioner (upqc): working principle. Capabilities and control strategies.

Text/Reference Books:

1. Hingorani N. G. and Gyugyi, L. (1999). *Understanding FACTS: Concepts and Technology of FACTS Systems*. Wiley-IEEE Press.

2. Padiyar, K. R. (2007). *FACTS Controllers in Power Transmission and Distribution.* New Age International (P) Ltd.

SEMESTER-IV

Course Title: ELECTRONIC DEVICES & CIRCUITS
Course Code: BEE411

L	T	P	Credits
3	0	0	3

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

1. Understand the PN junction diode –structure, operation and V-I characteristics
2. Understand the structure of basic electronic devices.
3. Be exposed to active and passive circuit elements.
4. Familiarize the operation and applications of transistor like BJT and FET.
5. Explore the characteristics of amplifier gain and frequency response.

Course Content

UNIT-I **10 Hours**

PN Junction Devices

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance.

Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener as regulator.

UNIT-II **15 Hours**

Transistors and Thyristors

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT Structure and characteristics.

Amplifiers

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT-III **10 Hours**

Multistage Amplifiers and Differential Amplifier

Cascade amplifier, Differential amplifier – Common mode and Difference mode analysis FET input stages – Single tuned amplifiers – Gain and frequency response Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT-IV **10 Hours**

Feedback Amplifiers and Oscillators

Advantages of negative feedback – voltage / current, series, Shunt feedback – positive feedback Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

Text / References Books:

1. Millman, J and Halkias, (1998) *Integrated Electronics*, TMH.
2. Ryder,J.D.(2003) *Electronic Fundamentals & Application*, PHI.
3. Boylestad R.L. (1997) *Electronic Devices and Circuit Theory, VIII Edition,* Pearson Education.
4. Sedra & Smith. (2000) *Microelectronic Circuits, V Edition,* Oxford University Press.
5. Millman and Taub. (2004) *Pulse digital and switching waveforms,* Mc-graw Hill, USA

SEMESTER-IV

Course Title: INDUSTRIAL SAFETY AND ENVIRONMENT

L	T	P	Credits
2	0	0	2

Course Code: BEE412

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

1. Understand the General safety rules, principles, maintenance, Inspections of turning machines
2. Design lathe-drilling-boring-milling-grinding-shaping-sawingshearingpresses- forge hammer-flywheels-shafts-couplings-gears-sprockets
3. Understand the Cold working, power presses, point of operation safe guarding, auxiliary mechanisms
4. Understand the Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries
5. Understand the Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing

Course Content

UNIT-I **5 Hours**

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

UNIT-II **10 Hours**

PRINCIPLES OF MACHINE GUARDING

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard

opening. Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawingshearingpresses- forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

UNIT-III **5 Hours**

SAFETY IN WELDING AND GAS CUTTING

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases- colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT-IV **10 Hours**

SAFETY IN COLD FORMING AND HOT WORKING OF METALS

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

SAFETY IN FINISHING, INSPECTION AND TESTING

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

Text/Reference Books:

1. Joselin, E.L.(1934). *Ventilation.* EdwardArnold.
2. Beranek, L.L.(1960). *Noise Reduction.* McGraw Hill.
3. DeReamer, R.(1980). *Modern Safety and health Technology*. RWiley.
4. Heinrich, H.W.(1959). *Industrial Accident Prevention.* McGraw Hill.

SEMESTER-IV

Course Title: Operating System

L	T	P	Credits
2	0	0	2

Course Code: BEE413

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

1. Design the algorithms to write programs.
2. Apply arrays, pointers and structures to formulate algorithms and programs
3. Apply programming to solve simple numerical method problems, namely rot finding
4. Function, differentiation of function and simple integration
5. To implement conditional branching, iteration and recursion Test and execute the programs and correct syntax and logical errors

COURSE CONTENT

UNIT-I **15 Hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System**.**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

UNIT-II **15 Hours**

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problematic.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery

UNIT-III **15 Hours**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation –Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).

UNIT-IV **15 Hours**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Suggested Readings

1. Charles Crowley. (1996). Operating System; *A Design-oriented Approach.* 1st Edition, Irwin Publishing.

2. Gary J. Nutt, Addison. (2002) .*Operating Systems: A Modern Perspective*. 2nd Edition Wesley.

3. Maurice Bach, Prentice-Hall of India (1986).*Design of the Unix Operation Systems.* 8thEdition.

4. Daniel P. Bovet, Marco Cesati, O'Reilly and Associates.(2005).*Understanding the Linux Kernel.* 3rd Edition

SEMESTER-IV

Course Title: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
Course Code: BEE414

L	T	P	Credits
2	0	0	2

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

1. Ability to understand connect up.
2. Explain basics of Indian traditional Knowledge in Modern scientific perspective.
3. Explain basic principles of thought process, reasoning Inferencing.
4. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
5. Ability to understand Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.

Course Content

UNIT-I **15 Hours**

Basic Structure of Indian Knowledge system, Modern Science and Indian Knowledge system, Yoga and Holistic Health Care, Case studies

Pedagogy: Problem based learning, group discussion, collaborative mini projects

UNIT-II **15 Hours**

Philosophical Tradition, Indian Linguistic Tradition (Phonology, morphology, syntax and semantics), Indian Artistic Tradition, Case studies

Pedagogy: Problem based learning, group discussion, collaborative mini projects

Text/Reference Books:

1. V.Sivarama krishnan (Ed.). (2014). Cultural Heritage of India-Course material, Bhartiya Vaidya Bhawan Mumbai 5th Edition.
2. Chaterjee S.C & Datta D.M . (1984). An introduction to Indian Philosophy, University of Calcutta.

SEMESTER-V

Course Title: Power System -I (Apparatus and Modelling)
Course Code: BEE501

L	T	P	Credits
3	1	0	4

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

1. Describe the basic concepts of power systems.
2. Classify the various power system components.
3. Evaluate fault currents for different types of faults.
4. Understand the generation of over-voltages and insulation coordination.
5. Analyze the dc transmission and renewable of energy system.

Course Content

UNIT-1 **15 Hours**

Basic Concepts

Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids.

Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

UNIT-II **15 Hours**

Power System Components

Conductor Materials; ACSR, hollow and bundle conductor. Different types of Tower, Stringing of conductor, spacing, sag, clearance from ground, overhead line insulator, concept of string efficiency. Choice & variation of frequency & voltage. Benefits of double circuit lines.

Parameters and performance of transmission lines

Introduction to Line Parameters, Resistance of Transmission Line, inductance of single phase two wire line, concept of G.M.D, Transposition of power lines, Effect of earth on capacitance of conductors. Representation of short Transmission Line,

medium length line, long length line, Diagram of Power Flow through transmission lines, ABCD constants.

UNIT-III **15 Hours**

Circle Diagram, Line Compensation and underground cables

Receiving end circle diagram for Long transmission line based on ABCD constants. Power loci, Surge impedance loading, Reactive power requirement of system series and shunt compensation, synchronous phase modifiers, rating of phase modifiers. Types of Cables based upon voltage & current rating, dielectric stress, capacitance of cable.

UNIT-IV **15 Hours**

Introduction to DC Transmission & Renewable Energy Systems

DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC) based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines.

Text/Reference Books:

1. Elgerd O.L.(2001) Electrical Energy System Theory - An introduction, (TMH)
2. Stevenson Jr W.D.(1999) Elements of Power System Analysis, TMH
3. Wadhwa C.L. (2000) Course in Electrical Power, New Age Int.(P)Ltd.
4. Nagrath and Kothari,(2003) Power System Analysis, (TMH)
5. Gupta, B.R. (2001) Power System Analysis & Design, Wheeler Publishing.

SEMESTER-V

Course Title: Control Systems
Course Code: BEE502

L	T	P	Credits
3	1	0	4

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

1. Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.
2. Analyze electromechanical systems by mathematical modelling.
3. Determine Transient and Steady State behavior of systems using standard test signals.
4. Analyze linear and non-linear systems for steady state errors, absolute stability and relative stability.
5. Identify and design a control system satisfying requirements.

Course Content

UNIT-I **15 Hours**

Introduction to control problem

Industrial control examples. Control hardware and their models. Transfer function models of linear time-invariant systems.

Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT-II **15 Hours**

Time Response Analysis

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response.

Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT-III **15 Hours**

Frequency-response analysis

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Introduction to Controller Design

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design.

UNIT-IV **15 Hours**

State variable Analysis

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Text/Reference Books:

1. Ogata, K. (1999) Modern Control Engg. Prentice Hall, New Delhi.
2. Gibsen, J.F. (2007) Control System Components, Mcgraw Hill.
3. Kuo, B.C.(1998) Automatic Control System, Prentice Hall.
4. Nagrath,I.J. (2004) Control System Engineering, Wiley Eastern Ltd., New Delhi.

SEMESTER-V

Course Title: MICROPROCESSORS AND ITS APPLICATIONS
Course Code: BEE503

L	T	P	Credits
3	0	0	3

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

1. Study of 8085 and 8086 Microprocessors.
2. Do assembly language programming.
3. Do interfacing design of peripherals like 8255, 8253, 8279, 8251 etc.
4. Develop systems using different microprocessors.
5. Identify and design a project using programmable Interrupt Controller

Course Content

UNIT-I **10 Hours**

Fundamentals of Microprocessors:

Digital Computers: General architecture and brief description of elements, programming system, Buses and CPU Timings. Microprocessor and Microprocessor Development Systems: Evolution of Microprocessor, memory, data transfer schemes, architecture advancements of microprocessors, typical microprocessor development system, higher lever languages.

UNIT-II **10 Hours**

The 8085 Architecture

Microprocessor architecture and its operations, Pin configuration, internal architecture. Timing & Signals: control and status, interrupt: ALU, machine cycles, Instruction format, op-codes, mnemonics, number of bytes, Instruction Set of 8085: Addressing Modes: Register addressing, direct addressing; register indirect addressing, immediate addressing, and implicit addressing. Machine cycles and T states, addressing modes. Instruction Classification: Data transfer, arithmetic operations, logical operations, branching operation, machine control; Writing assembly Language programs, Assembler directives.

UNIT-III **10 Hours**

The 8086 Architecture

8086 Microprocessors: Architecture: Architecture of INTEL 8086 (Bus Interface Unit, Execution unit), register organization, memory addressing, memory segmentation, Operating Modes Instruction Set of 8086 Addressing Modes: Instruction format: Discussion on instruction Set: Groups: data transfer,

arithmetic, logic string, branch control transfer, processor control. Interrupts: Hardware and software interrupts, responses and types.

UNIT-IV **10 Hours**

Peripheral memory and I/O Interfacing

Interfacing devices, Interfacing of Memory, Programmed I/O, Interrupt Driven I/O, memory I/O, 8255- Programmable peripheral interface, 8253/8254 Programmable timer/counter. 8259 programmable Interrupt Controller, 8251-USART.

Text/Reference Books:

1. Ramesh. S. Gaonkar,(2000) Microprocessor Architecture, Programming and applications with the 8085, Penran International Publishing
2. Muhopadhyay A.H.(1998) Microprocessor Based Laboratory Experiments and Projects, Wheeler Publishing.

SEMESTER-V

Course Title: WIND AND SOLAR ENERGY
Course Code: BEE504

L	T	P	Credits
3	0	0	3

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

1. Identify with the energy scenario and the consequent growth of the power generation from renewable energy sources.
2. Know the issues related to the grid-integration of solar and wind energy systems.
3. Realize the basic physics of wind and solar power generation.
4. Understand the power electronic interfaces for wind and solar generation.
5. Analyze the solar thermal power generation.

Course Content

UNIT-I **10 Hours**

Physics of Wind Power:

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

UNIT-II **10 Hours**

Wind generator topologies:

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

UNIT-III **10 Hours**

The Solar Resource:

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Solar photovoltaic:

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

UNIT-IV **10 Hours**

Network Integration Issues:

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Solar thermal power generation:

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Text/Reference Books:

1. Ackermann, T. (2005) Wind Power in Power Systems. John Wiley and Sons Ltd.
2. Masters, G. M. (2004). Renewable and Efficient Electric Power Systems. John Wiley and Sons.
3. Sukhatme, S. P. (1984). Solar Energy: Principles of Thermal Collection and Storage. McGraw Hill.

SEMESTER-V

Course Title: POWER SYSTEM -I LAB
Course Code: BEE505

L	T	P	Credits
0	0	2	1

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

1. Identify with the concepts of power systems.
2. Classify the various power system components.
3. Evaluate fault currents for different types of faults.
4. Understand the generation of over-voltages and insulation coordination.
5. Understand basic protection schemes.

Course Content

15 Hours

Hands-on experiments related to the course contents.

Visits to power system installations (generation stations, EHV substations etc.) are Exposure to fault analysis and Electro- magnetic transient program (EMTP) and Numerical Relays are suggested.

Suggested List of Experiments:

(A) Hardware Based:

1. To measure negative sequence and zero sequence reactance of Synchronous Machines.
2. Fault analysis for line-to-line (L-L), Line-to-Ground (L-G) and double line to ground fault.
3. To study the performance of a transmission line and compute its ABCD parameters.
4. To study the earth resistance using three spikes.
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays.
8. To study operation of oil testing set.

SEMESTER-V

Course Title: Control Systems Lab
Course Code: BEE506

L	T	P	Credits
0	0	2	1

Total Hours: 15

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

1. Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.
2. Analyze electromechanical systems by mathematical modelling.
3. Determine Transient and Steady State behavior of systems using standard test signals.
4. Analyze linear and non-linear systems for steady state errors, absolute stability and relative stability.
5. Identify and design a control system satisfying requirements.

COURSE CONTENT

15 Hours

Note: A student to perform any 8-10 Experiments.

Suggested List of Experiments:

1. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
2. To study the synchro Transmitter-Receiver set and to use it as an error detector
3. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
4. To study the Speed – Torque characteristics of an DC Servo Motor and explore its applications.
5. To study the variations of time lag by changing the time constant using control engineering trainer
6. To simulate a third order differential equations using an analog computer and calculate time response specifications
7. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer

8. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop systems
   (i) To study the operation of a position sensor and study the conversion of position in to corresponding voltage
   (ii) To study PI control action and show its usefulness for minimizing steady state error of time response.
9. To measure Force / Displacement using Strain Gauge in a wheat stone bridge
10. To design a Lag compensator and test its performance characteristics.
11. To design a Lead-compensator and test its performance characteristics.
12. To design a Lead-Lag compensator and test its performance characteristics.

SEMESTER-V

Course Title: MICROPROCESSORS & ITS APPLICATIONS LAB
Course Code: BEE507

L	T	P	Credits
0	0	2	1

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

1. Study of 8085 and 8086 Microprocessors.
2. Do assembly language programming.
3. Do interfacing design of peripherals like 8255, 8253, 8279, 8251 etc.
4. Develop systems using different microprocessors.
5. Identify and design a project using programmable Interrupt Controller

Course Content

15 Hours

Note: A student to perform any 8-10 Experiments.

Suggested List of Experiments:

1. To study 8085 based microprocessor system
2. To study 8086 and 8086A based microprocessor system
3. To study Pentium Processor
4. To develop and run a program for finding out the largest/smallest number from a given set of numbers.
5. To develop and run a program for arranging in ascending/descending order of a set of numbers
6. To perform multiplication/division of given numbers
7. To perform conversion of temperature from 0 F to 0 C and vice-versa
8. To perform computation of square root of a given number
9. To perform floating point mathematical operations (addition, subtraction, multiplication and division)
10. To obtain interfacing of RAM chip to 8085/8086 based system
11. To obtain interfacing of keyboard controller, 8279
12. To obtain interfacing of PPI, 8255
13. To obtain interfacing of USART, 8251
14. To perform microprocessor-based stepper motor operation through 8085 kit
15. To perform microprocessor-based traffic light control

SEMESTER-V

Course Title: LEADERSHIP AND PERSONALITY DEVELOPMENT
Course Code: BEE508

L	T	P	Credits
2	0	0	2

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

1. Know themselves better.
2. Identify their own potentials and accept their own limitations.
3. Consciously overcome their limitations and move towards self-esteem.
4. Maximize their own potential in enabling a holistic development.

Course Content

UNIT-I **7 Hours**

Leadership: Definition and meaning, Importance, Leadership and Management, Leader vs Manager, Essential qualities of an effective leader

UNIT-II **6 Hours**

Theories of Leadership: Trait theory, Behavioural theories, Contingency Theory.

UNIT-III **8 Hours**

Types of Leaders, Leadership styles: Traditional, Transactional, Transformational, Inspirational and servant leadership and Emerging issues in leadership: Emotional Intelligence and leadership, Trust as a factor, Gender and Leadership

UNIT-IV **9 Hours**

Personality: Concept and Definition, Determinants of personality, Personality traits, Personality characteristics in organizations: Self evaluation, Locus of control, Self-efficacy, Self-esteem, Self-monitoring: Positive and negative Impact. Organizational Context of Leadership and Personality, Contemporary Business Leaders.

Text/Reference Books:

1. Organisational Behaviour, M.Parikh and R.Gupta , Tata Mc-Graw Hill Education Private Limited

2. Organisational Behaviour, D. Nelson, J.C Quick and P. Khandelwal, Cengage Publication.

SEMESTER-V

Course Title: DIGITAL CONTROL SYSTEMS
Course Code: BEE509

L	T	P	Credits
3	0	0	3

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

1. Use ordinary differential equations and Laplace transformation to model physical systems.
2. Obtain dynamic responses of linear systems and determine their stability
3. Construct root-locus and Bode plots, and apply Nyquist criterion in the context of controller design.
4. Obtain and manipulate state-space representation of dynamical systems using linear algebra.
5. Translate a set of performance specifications given in words to a formal description of a design problem, and then design a suitable feedback-controller using design tools, followed by simulation and verification using software tools.

Course Content

UNIT –I **10 Hours**

Introduction:

Block Diagram of typical control system- advantages of sampling in control systems – examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals –ZOH. Z-transform: Definition and evaluation of Z-transforms – mapping between s-plane and z-plane – inverse z-plane transform – theorems of the Z-transforms –limitations of z-transforms –pulse transfer function –pulse transfer function of ZOH –relation between G(s) and G(z) – signal flow graph method applied to digital systems.

UNIT- II **15 Hours**

State Space Analysis:

State space modelling of digital systems with sample and hold – state transition equation of digital time in variant systems – solution of time in variant discrete state equations by the Z-Transformation – transfer function from the state model – Eigen values – Eigen vector and diagonalisation of the A-matrix – Jordan canonical form. Computation of state transition matrix-Transformation to phase to variable canonical form-The state diagram – decomposition of digital system – Response of sample data system between sampling instants using state approach. Stability: Definition of stability – stability tests – The second method of Liapunov.

UNIT- III **10 Hours**

Time Domain Analysis:

Comparison of time response of continuous data and digital control systems-correlation between time response and root locus j the s-plane and z-plane – effect of pole-zero configuration in the z-plane upon the maximum overshoot and peak time of transient response – Root loci for digital control systems – steady state error analysis of digital control systems – Nyquist plot – Bode plot-G.M and P.M.

UNIT- IV **10 Hours**

Design:

The digital control design with digital controller with bilinear transformation – Digital PID controller-Design with deadbeat response-Pole placement through state feedback-Design of full order state observer-Discrete Euler Lagrance Equation – Discrete maximum principle.

Digital State Observer:

Design of – Full order and reduced order observers. Design by max. Principle: Discrete Euler language equation-discrete maximum principle.

Text/Reference Books:

1. K. Ogata, “Discrete Time Control Systems”, Prentice Hall, Englewood Cliffs, New Jersey.
2. Charles L. Phillips, “Digital Control System: Analysis and Design”, Prentice Hall, Englewood Cliffs, New Jersey.

SEMESTER-V

Course Title: COMPUTER NETWORKS
Course Code: BEE510

L	T	P	Credits
3	0	0	3

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

1. Capability to understand the terminology and concepts of the OSI reference model and the TCP:IP reference model
2. Ability to understand the concepts of protocols, network interfaces, design/performance issues in local area networks and wide area networks.
3. Be familiar with wireless networking concepts
4. Explore contemporary issues in networking technologies
5. Ability to understand the network tools and network programming.

Course Content

UNIT-I **10 Hours**

Computer Networks

Introduction, Classification of Computer Networks, LAN, MAN, WAN. Internet, Intranet & Extranet, Wired Network Vs Wireless Network, Network Topologies.

Data Communication Concepts

Digital & Analog Signals, Synchronous & Asynchronous, Data Transmission Modes.

Network Reference Models

OSI reference Model, Functions of each layer, TCP/IP reference Model, comparison of OSI & TCP/IP Models.

UNIT-II **10 Hours**

Networking Hardware

Ethernet cabling, NIC, Repeater, Router, Bridges, Switches, Transceivers, hubs, Cable and Modems.

Multiplexing and Switching

FDM, TDM, WDM, Circuit Switching, Packet Switching & Message Switching & Comparison of Various Switching techniques.

UNIT-III **10 Hours**

Data link & Network Layer

Services provided to N/W layer, Framing, Data link control: Flow Control, Error Detection & Correction Methods, HDLC & SDLC, Concept of Routing& its Algorithms, Congestion control.

LAN standards

(IEEE PROJECT 802): Ethernet, CSMA/CD, Token Ring, Token Bus & their frame formats. FDDI.

UNIT-IV **15 Hours**

Transport Layer:

Transport layer Protocols like TCP, UDP, Connection Oriented Transport Protocol, TCP services.

N/W Protocols: FTP, SMTP & MIME & POP3

Modern Applications:

Web Applications: - HTTP, Internet and its Applications.

Text/Reference Books:

1. Forouzan, Behrouz A. *Data Communications and Networking.* Tata McGraw Hill Publishing Company, 2000.
2. Miklovic, Daniel T. *Real time control network.* ISA , 1993.
   Tanenbaum, Andrew S. *Computer Networks.* Pearson Education, 2002
3. Comer, Douglas E. *Computer Networks and Internets.* Pearson Education Asia, 2001.
4. Dcou Reynders, Steve Mackay, Edwin Wright. *Practical Industrial Data Communications.* 1st edition Elsevier, 2005.

SEMESTER-V

Course Title: DIGITAL SIGNAL PROCESSING
Course Code: BEE511

L	T	P	Credits
3	0	0	3

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

1. Interpret, represent and process discrete/digital signals and systems.
2. Thorough understanding of frequency domain analysis of discrete time signals.
3. Ability to design & analyze DSP systems like FIR and IIR Filter etc
4. Practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors.
5. Understanding of spectral analysis of the signals.

Course Content

UNIT-I **10 Hours**

Introduction

Basic elements of DSP system, Advantages and disadvantage of DSP over analog processing, Application of Digital signal processing.

Discrete Time Signal and Systems

Elementary discrete time signals, Manipulation of discrete time signals, Classification of discrete time LTI system using convolution sum method, properties of LTI system, Analysis of LTI system using Difference equation.

UNIT-II **10 Hours**

Z-Transform

Direct Z-Transform and importance of ROC, properties of Z-Transform, Inverse Z-transform methods, system function of LTI systems in Z-domain, Relationship between Z-transform and Fourier transform, one sided Z – Transform.

Discrete Fourier Transform

Frequency domain sampling and reconstruction of discrete time signal, DFT as linear transformation, properties of DFT, use of DFT in linear filtering, fast

fourier transform (FFT), decimation in time, decimation in frequency algorithm, Goertzel algorithm.

UNIT-III **15 Hours**

Implementation of Discrete Time System

Structures for realization of discrete time system, Direct form, cascade form, parallel form and lattice form structures for FIR and IIR systems, Representation of numbers, errors resulting for rounding and truncation.

Application in DSP

Digital Audio and instrumentation-Digital Audio, Digital Control, Digital frequency oscillator. Telecommunication- Touch tone generator, DTMF detection using Goertzel algorithm.

UNIT-IV **10 Hours**

Design of Digital Filters

Fundamentals of filter design, Design of FIR filter using Window method, Design of IIR filter by Impulse invariance, bilinear transformation and matched Z transform technique, Analog and digital domain frequency transformation.

Text/Reference Books:

1. John G. Proakis and Dimitris G. Manolakis. (2001). Digital Signal Processing Principles, Algorithm and Application. Prentice Hall India Pvt. Ltd.
2. Emmanuel C. Ifeachor and Barrie W. Jervis. (1999). Digital signal processing. Pearson Education.

SEMESTER-VI

Course Title: POWER SYSTEMS-II (Operation and Control)
Course Code: BEE601

L	T	P	Credits
3	1	0	4

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

1. Develop small scale model of alternator, excitation and governing systems.
2. Decide the scheduling of thermal units and hydro-thermal units for overall economy.
3. Design and apply control for frequency and voltage of power system represented by multi area
4. Comprehend power system security and contingency.
5. Computation of small scale and voltage stability.

COURSE CONTENT

UNIT-I **10 Hours**

Economic Operation of Power Systems: Fuel consumption, Characteristics of thermal unit, Incremental fuel rate and their approximation, Minimum and maximum power generation limits.

UNIT-II **15 Hours**

Economic Dispatch: Economic dispatch problem with and without transmission line losses, Unit Commitment, methods for their solutions. Hydrothermal Co-ordination: Hydro-scheduling, Plant models, Scheduling problems, Hydro-thermal scheduling problems and its approach.

UNIT-III **15 Hours**

Power System Control: Ideas of load frequency and voltage control, Reactive power control, Block diagrams of P-f and Q-V controllers, ALFC control, Static and dynamic performance characteristics of ALFC and AVR controllers, Excitation systems model, concept of area and Tie-line operations.

UNIT-IV **20 Hours**

Power System Security: Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and

linear programming. Small Scale Stability Analysis: d-q model of generator, State space representation, Eigen value and participation factor analysis.

Voltage Stability: Basic concepts, Voltage collapse, P-V and Q-V curves, Impact of load, Static and dynamic analysis of voltage stability, Prevention of voltage collapse.

Text/Reference Books:

1. Rao, S. (2001). Testing, Commissioning, Operation and Maintenance of Electrical Equipment by Khanna Technical Publication. New Delhi
2. Wadhwa, C.L. (1996) Electrical Power Systems. Wiley Eastern Ltd. New Delhi
3. Uppal, S.L. (2003). Electrical Power. Dr. Khanna Publications. Delhi.
4. A.J. Wood, B.F. Woolenberg (2013). Power Generation Operation and Control. John Wiley and Sons.
5. Chakrabarty Abhijit (2006). Power System Analysis, Operation and Control. PHI Learning, New Delhi.

SEMESTER-VI

Course Title: PROGRAMMABLE LOGIC CONTROLLERS
Course Code: BEE602

L	T	P	Credits
3	1	0	4

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

1. Analyse the major components of PLC.
2. Interpret the operation of PLC modules.
3. Execute the PLC programming with different conditions.
4. Establish communication and networking with PLC.
5. Computation of Programming based on basic instructions, timer, counter, sequencer

Course Content

UNIT-I **15 Hours**

Introduction to PLC

Introduction, relative merits over hard-wired logic and relay. PLC based design of power converters, PLC based control of DC and AC Drives Process Control, Advantages, Applications Building blocks of PLC, Functions of various blocks, concept of PLC.

UNIT-II **15 Hours**

Working of PLC

Basic operation and principles of PLC Architectural details processor Memory structures, I/O structure Programming terminal, power supply

UNIT-III **15 Hours**

Instruction Set Basic instructions like latch, master control, self-holding relays. Timer instruction like retentive timers, resetting of timers. Counter instructions like up counter, down counter, resetting of counters. Sequencers, output sequencers, input sequencers, time driven, and event driven sequencers, masking etc. Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal, mask equal limit etc.

UNIT-IV **15 Hours**

Ladder Diagram Programming

Programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program.

Text/Reference Books:

1. Otter, J.D. (2000). Programmable Logic Controller. P.H. International, Inc, USA
2. Dunning, G. (1999). Introduction to PLCs. McGraw Hill.

SEMESTER-VI

Course Title: GENERATION OF ELECTRICAL POWER
Course Code: BEE603

L	T	P	Credits
3	0	0	3

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

1. Get knowledge of India's power scenario, power system structure and related agencies.
2. Select the methods and size of plant generating power for overall economy.
3. Decide the tariff structure for different type of users.
4. Understand the Power Plant Economics.
5. Knowledge of Energy and environment, Air pollution, Aquatic impacts, nuclear plant and hydro plant impacts.

Course Content

UNIT-I **5 Hours**

Introduction: Electrical energy sources, organization of power sector in India, single line diagram of thermal, hydro and nuclear power stations.

UNIT-II **10 Hours**

Loads and Load curves: Maximum demand, Group diversity factor, Peak diversity factor, Types of load, chronological load curves, load-duration Curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.

Power Plant Economics: Capital cost of plants, annual fixed cost, operating costs and effect of load factor on cost of energy, depreciation.

UNIT-3 **15 Hours**

Tariffs and power factor improvement: Objectives of tariff making, different types of tariff for domestic, commercial, agricultural and Industrial loads. Need for p.f. improvement, p.f. improvement using capacitors, determination of economic p.f.

Selection of plant: Plant location, plant size, no. and size of units in plants, economic comparison of alternatives , annual cost , rate of return, present worth and capitalized cost methods.

Economic operation of steam plants: Methods of loading turbo-generators, input- output curve, heat rate, incremental cost, method of lagrangian multiplier, effect of transmission losses, co ordination equations, iterative procedure to solve co-ordination equations.

UNIT-IV **15 Hours**

Hydro-thermal co-ordination: Advantages, combined working of run off river plant and steam plant, reservoir hydro plants and thermal plants-long term operational aspects, scheduling methods.

Pollution and environmental problems: Energy and environment, Air pollution, Aquatic impacts, nuclear plant and hydro plant impacts.

Cogeneration: Definition and scope, Topping and Bottoming Cycles, Benefits, cogeneration technologies.

Text/Reference Books:

1. Gupta, B.R.(2000). Generation of Electric Energy. S.Chand & Co. Delhi.

2. Dom, K. (1998) Power Plant Engineering S.Chand & Co. Delhi.

SEMESTER-VI

Course Title: OPERATION RESEARCH
Course Code: BEE604

L	T	P	Credits
2	0	0	2

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

1. Comprehend the role of operation research in decision-making, and its applications in industry and design for real-world problems through models & experiments
2. Apply various types of deterministic models like linear programming, transportation model etc.
3. Analyze various types of stochastic models like waiting line model, project line model, simulation etc.
4. Develop the relationship between a linear program and its dual and perform sensitivity analysis.
5. Understand the decision making environment and apply decision making process in the real world situations.

Course Content

UNIT-I **8 Hours**

Introduction:

Origin & development of OR and its role in solving industrial problems: General approach for solving OR problems. Nature and characteristic feature of OR. Use and limitation of OR. Classification of mathematical models.

Deterministic Models:

Formulation of deterministic linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis: transportation models, test for optimality, degeneracy in transportation. Assignment problems (Hungarian method) travelling salesman problems, and sequencing models; Introduction to goal programming; Solution techniques of linear goal programming problems.

UNIT-II **8 Hours**

Probabilistic Models:

Decision making: various decision making environments. Maximum and minimum models; Introduction to decision tree. Game theory: Solution of simple two person zero-sum games: Examples of simple competitive situation.

Simulation:
Concept general approach and application. Use of Monte-Carlo simulation technique to queuing and inventory problems.

Dynamic Programming:
Introduction to deterministic and probabilistic dynamic programming, Solution of simple problems, Advantages of dynamic programming.

UNIT-III **7 Hours**

Queuing theory:
Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

Replacement Models:
Replacement of items that deteriorate, Replacement of items whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with time and value of money also changes, individual replacement policy, group replacement policy.

UNIT-IV **7 Hours**

Inventory models:
Classification of inventory control models: Inventory models with deterministic demand, inventory models with probabilistic demand, and inventory models with price breaks. Advantages and disadvantage of inventory.

Network models:
PERT & CPM introduction, analysis of time bound project situations, construction of net works, identification of critical path, slack and floats, crashing of network for cost reduction, resource levelling and smoothening.

Text/Reference Books:

1. Wagner, H.M.(1980). *Principles of Operations Research.*Prentice Hall.
2. Gupta, P.K. & Hira, D.S.(1976).*Operations Research.* S. Chand &Co.
3. Taha, H. (1999). *Introduction to Operation Research*. Pearson.
4. Hillier, F. S. & Lieberman, G. J. (1967). *Introduction to Operations Research*. San Francisco: Holden-Day.

SEMESTER-VI

Course Title: POWER SYSTEMS-II LAB
Course Code: BEE605

L	T	P	Credits
0	0	2	1

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

1. Knowledge of various abnormal conditions that could occur in power system
2. Design various protective devices in power system for protecting equipment and personnel.
3. Familiarity of various types of existing circuit breakers, their design and constructional details.
4. Awareness of various conventional relays, their design and latest developments.
5. Knowledge of standards and specifications related to switchgear and protection.

Course Content

15 Hours

Laboratory Work:

Simulation of thermal scheduling with and without losses, Unit commitment by dynamic programming, simulation of hydro-thermal scheduling by gradient method, Stability analysis of single area frequency control, Bias control of two area system and AVR.

SEMESTER-VI

Course Title: PROGRAMMABLE LOGIC CONTROLLERS LAB
Course Code: BEE606

L	T	P	Credits
0	0	2	1

Total Hours: 15

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

1. Acquire the knowledge of various abnormal conditions that could occur in power system
2. Ability to design various protective devices in power system for protecting equipment and personnel.
3. Knowledge of various types of existing circuit breakers, their design and constructional details.
4. Knowledge of various conventional relays, their design and latest developments.
5. Knowledge of standards and specifications related to switchgear and protection

Course Content

15 Hours

LIST OF PRACTICALS

1. Familiarization with the working of PLC.
2. Components/Sub-Components of a PLC, learning functions of different modules of PLC System.
3. Introduction to step 5 programming language, ladder diagram concepts, instruction list syntax.
4. Basic logic operations, AND, OR, NOT functions.
5. Logic control systems with time response as applied to clamping operation.
6. Sequence control system e.g. In lifting a dense for packaging and counting.
7. Wiring, entering and testing programs wiring a hand-held programmer for the following operations: - Ladder Logic, Timers, Counters, Sequencers
8. Wiring, entering and testing programs using computers for the following operations: Ladder logic, timers, counters, sequencers
9. Assembly language programming.

10. Write a program for LCD interface.
11. Write a program for A/D converter, result on LCD.
12. Write a program for D/A converter, showing the result on LCD.
13. Write a program for serial data transmission from kit to PC.
14. Development of a small working programs using PLC.

SEMESTER-VI

Course Title: ELECTRIC DRIVES
Course Code: BEE607

L	T	P	Credits
3	0	0	3

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

1. Understand the basic concept of dynamics of Electric Drives.
2. Analyze the multi-quadrant operations of dc and motors.
3. Evaluate the motor rating for duty cycles.
4. Understand the various drive mechanisms and methods for energy conservation.
5. Knowledge of single-phase and three-phase semi converter and full-converter phase-controlled configurations

Course Content

UNIT-I **10 Hours**

Definitions, Dynamics of Electric Drives: Concept of electric drive and its classifications, Types of loads, Four-quadrant drive, and dependence of load torque on various factors, Dynamics of motor-load combination, Steady state stability of an electric drive system. Load Equalization

UNIT-II **10 Hours**

Drive Features of Importance: Multi-quadrant operations of DC and AC motors. Energy relations during starting and braking.

Static Control of Motors: Contactors and relays for electric drives. Control circuits for automatic starters of DC and AC motors including definite time accelerating type.

UNIT-III **10 Hours**

Estimation of Motors Rating: Types of duty cycles, Calculation of motor rating for duty cycles, Use of load diagrams.

UNIT-IV **15 Hours**

Semiconductor Controlled Drives: Control of DC drives fed through single-phase and three-phase semi converter and full-converter phase-controlled configurations. Their analysis, Regeneration and braking through static power converters, Control

of three phase induction motors by stator voltage and frequency control for speeds below and above synchronous speed. Static Rotor resistance control, Static Kramer and Scherbius drives.

Text/Reference Books:

1. Pillai, S.K. (2000) A First Course On Electrical Drives, New Age Publications.

SEMESTER-VI

Course Title: SENSORS AND TRANSDUCERS
Course Code: BEE608

L	T	P	Credits
3	0	0	3

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

1. Use concepts in common methods for converting a physical parameter into an electrical quantity.
2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light.
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc.
4. Locate different type of sensors used in real life applications and paraphrase their importance.
5. Set up testing strategies to evaluate performance characteristics of different types of sensors and transducers and develop professional skills in acquiring and applying the knowledge outside the classroom through design of a real-life instrumentation system.

Course Content

UNIT-I **5 Hours**

Introduction to Electronics Measurement and Instrumentation:

Transducers and sensors- Accuracy and precisions, types of errors, statistical analysis, probability of errors, limiting errors, sensitivity, linearity, hysteresis, resolution, reproducibility, transfer function.

UNIT-II **15 Hours**

Analog Signal Conditioning:

Signal conditioning, Loading effects, Bridges for measurement techniques, Wheatstone, Wein's, Kelvin's, Maxwell bridge and Hey's bridge, Attenuators and Amplifiers, Passive filters, Op-amp based signal conditioning circuits, Inverting and Non-Inverting Amplifiers, Differential amplifiers and Instrumentation amplifiers.

Digital Signal Conditioning:

Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Weighted Resistor DAC, R-2R ladder DAC, Dual Slope, Parallel-comparator Successive Approximation ADC techniques, Single channel and multi-channel Data Acquisition System (DAS).

UNIT-III **10 Hours**

Temperature Sensors:

Resistance Vs Temperature characteristics for different materials, Thermistors, Thermocouples - thermoelectric effects for thermocouples, thermocouple tables, RTD, Other Thermal Sensors.

UNIT-IV **15 Hours**

Pressure, force, displacement and weight measurement:

Capacitive and inductive transducers, Displacement Sensor (LVDT), Strain Sensors – strain gauges, its principle, applications, types of strain gauges, Load cells, Piezo-electric sensors, Motion sensors.

Flow Measurement:

Basic principle of flow meter, Differential pressure flow meters, Variable area flow meter, volumetric flow meter, Hotwire anemometer, Magnetic and ultrasonic flow meter, Rota meter, Hall Effect transducer working and measurement techniques

Text/Reference Books:

1. Curtis D. Johnson. Process Control Instrumentation Technology, Prentice Hall India.

2. D.V.S. Murty. Transducers and Instrumentation, Prentice Hall India.

3. Helfrick Albert D. and Cooper W. D..Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall India.

4. Kalsi H. S. Electronic Instrumentation, Tata McGraw-Hill Education.

5. Shawhney A. K. A Course In Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai& Sons, 11th Ed., 1999.

6. Bell David A. Electronic Instrumentation and Measurements, PHI / Pearson Education.

SEMESTER-VI

Course Title: DATA STRUCTURE
Course Code: BEE609

L	T	P	Credits
3	0	0	3

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

1. Understand data structures concepts with arrays, stacks, queues.
2. Develop linked lists for stacks, queues and for other applications. •
3. Understand traversal methods in the Trees.
4. Develop various algorithms available for the graphs.
5. Use sorting and searching in the data ret retrieval applications.

Course Content

UNIT-I: **12 Hours**

Linear Data Structures: Arrays, Stacks and Queues:

Data Structures -Operations-Abstract Data Types-Complexity of Algorithms-Time and Space Arrays-Representation of Arrays-Linear Arrays-Insertion–Deletion and Traversal of a Linear Array-Array as an Abstract Data Type-Multi-Dimensional arrays-Strings-String Operations-Storing Strings-String as an Abstract Data Type. Stack -Array Representation of Stack-Stack Abstract Data Type-Applications of Stacks: Prefix, Infix and Postfix Arithmetic Expressions-Conversion-Evaluation of Postfix Expressions-Recursion-Towers of Hanoi-Queues-Definition-Array Representation of Queue-The Queue Abstract Data Type-Circular Queues-Dequeues-Priority Queues.

UNIT-II: **11 Hours**

Linked Lists:

Pointers-Pointer Arrays-Linked Lists-Node Representation-Single Linked List-Traversing and Searching a Single Linked List-Insertion into and Deletion from a Single Linked List-Header Linked Lists-Circularly Linked Lists-Doubly Linked Lists-Linked Stacks and Queues Polynomials-Polynomial Representation-Sparse Matrices.

UNIT-III: **12 Hours**

Trees:

Terminology-Representation of Trees-Binary Trees-Properties of Binary Trees-Binary Tree Representations-Binary Tree Traversal-Preorder-Inorder and Postorder Traversal-Threads-Thread Binary Trees-Balanced Binary Trees-Heaps-Max Heap-Insertion into and Deletion from a Max Heap-Binary Search Trees-Searching-Insertion and Deletion from a Binary Search Tree Height of Binary Search Tree, m-way Search Trees, B-Trees.

Unit-IV: **10 Hours**

Graphs

Graph Theory Terminology-Graph Representation-Graph Operations-Depth First Search-Breadth First Search-Connected Components-Spanning Trees-Biconnected Components-Minimum Cost Spanning Trees-Kruskal's Algorithm-Prism's Algorithm-Shortest Paths-Transitive Closure-All-Pairs Shortest Path-Warshall's Algorithm.

Text/Reference Books:

1. Fundamentals of Data Structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson Freed, Universities Press Pvt. Ltd.
2. Data Structures with C, Seymour Lipschutz, Schaum's Outlines, Tata McGraw Hill.

SEMESTER-VI

Course Title: ELECTRIC AND HYBRID VEHICLES
Course Code: BEE610

L	T	P	Credits
3	0	0	3

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

1. Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
2. Understand hybrid drive-train topologies
3. Attain the knowledge about DC motor drives configuration and control
4. Understand the selection and sizing of energy storage systems
5. Compare different energy management strategies

Course Content

UNIT-I **10 Hours**

History of Hybrid and Electric Vehicles**:** Social and environmental importance of hybrid and electric vehicles, Impact of modern drive-trains on energy supplies, Basics of vehicle performance, vehicle power source characterization Transmission characteristics.

UNIT-II **10 Hours**

Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis.

UNIT-III **10 Hours**

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance, Drive system efficiency.

UNIT-IV **15 Hours**

Matching the Electric Machine and Internal Combustion Engine: Sizing the propulsion motor, selecting the energy storage technology, sizing the power

electronics devices for energy storage, Classification of different energy management strategies Comparison of different energy management strategies Implementation issues of energy strategies.

Text/Reference Books:

1. Ramirez S., Ortigoza R. S. (2011) Control Design Techniques in Power Electronics Devices.Springer.
2. Tan S.C.,Y.M.Laiand C.K.Tse (2012) Sliding mode control of switching Power Converters.CRCpress.

SEMESTER-VI

Course Title: POWER PLANT ENGINEERING
Course Code: BEE611

L	T	P	Credits
3	0	0	3

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

1. Find out the efficiency and output of Rankine cycle Steam Power Plant from given data, including, super heat, reheat, regeneration and reversibility's.
2. Explicate the blade shapes, and calculate work output of typical turbine stages.
3. Explain major types of hydro power and wind power turbines.
4. Clarify the basic principal of thermal fission and fast breeder nuclear power plant.
5. Understand the basics of pollution control methods.

Course Content

UNIT-I **15 Hours**

Steam Generators, Condensers and Turbines:
Classification of steam generators, selection, operation of locomotive, Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbine efficiencies, compounding, governing and control.

Steam Power Plant:
Classification, Operation, Description of Rankine cycle, Regenerative cycle, Reheat-Regenerative Cycle, Binary Vapour Cycle, Selection of plant site and its layout, coal handling system, combustion system, Fluidized bed combustion, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.

UNIT-II **10 Hours**

Hydro-Electric Power Plants:
Hydrological Cycle, Hydrograph, Flow duration curve, Selection of site, Essential features, Classification of hydro plants, Selection of water turbines for hydro power plant, Automatic and remote control of hydro station, layout of hydro power plant.

Nuclear power plants:
Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Site selections, safety measures, plant layout, Fusion reaction, Future of nuclear power.

UNIT-III **10 Hours**

Gas Turbine:
Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Thermal refinement to gas turbines cycle, Plant layout, applications, gas turbines Cycle calculations.

Diesel Power Plants:
Classifications of IC Engines and their performance, Four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Celane number, knocking, super charging, operation and layout of diesel power plant.

UNIT-IV **10 Hours**

Combined Operation of Different Power Plants:
Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.

Pollution Control:
Pollution from thermal & nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

Text/Reference Books:
1. Sharma, P.C. (1999) Power Plant Engineering (Kataria & Sons)
2. Skrotzki, B.G.A. & Vapot, W. (2001) A Power Station Engineering and Economy (TMH)
3. Rajput, R.K. (1997) Power Plant Engineering (Luxmi Publications)

SEMESTER-VI

Course Title: COMPUTER AIDED DESIGN
Course Code: BEE612

L	T	P	Credits
3	0	0	3

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

1. Comprehend the various software used in CAD and the functions of a graphics package.
2. Understand the various concepts and characteristics in geometric modeling.
3. Analyze the components and systems of NC and CNC machine tools.
4. Apply the various programming methods for specific jobs.
5. Differentiate the FMS and CIMS with reference to components, advantages and applications.

Course Content

UNIT-I **10 Hours**

Introduction:
Overview of conventional design & manufacturing process, computer's role in design, benefits of computer application, relation of CAD with CAM, history of CAD development, current trends in CAD.

CAD Hardware & Software:
Central processing unit, memory, input & output devices, types of computer systems, computer programming, general information of various software for CAD, types of file formats & their exchange, graphics standards**.**

UNIT-II **10 Hours**

Geometric Modeling:
Curve representation methods, surface representation methods, half spaces, boundary representation (B-rep), sweep representation, constructive solid geometry (CGS), solid manipulations, modeling facilities desired.

Transformations:
Translation, rotation, scaling symmetry, reflection, homogeneous transformations, orthographic projections, axonometric projections, oblique projections, perspective transformation.

UNIT-III **15 Hours**

Visual Realization:
Basic concepts of visual realization, hidden line removal, hidden surface removal, shading surfaces and solids visibility techniques, sorting coherence, hidden line removal for curved surface.

CAD and CAM integration:
Introduction, part production cycle, manufacturing system, process, integration requirements, process planning, tool path generation and verification, Design and Engg. applications.

UNIT-IV **10 Hours**

Introduction to Design and Engineering Applications:
Geometry and mass property formulations. Practice on Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning and solid modeling on available CAD packages.

Text/Reference Books:

1. Groover, M. &Zimmers,E.(1984). CAD/CAM. Prentice Hall of India
2. Groover, M.P.(1980).Automation: Production Systems &CAM. Englewood Cliffs New Jersey
3. Chang, T.C. &Wysk, R.A.(1985). An introduction to Automated Process Planning. Longman Higher Education
4. Singh, N.(1995).System approach to Computer Integrated Design and Manufacturing. Wiley.
5. Pable, B.S. & Adithan, M.(1994). CNC Machines. New Age International (P) Ltd.
6. Dalela, S.& Jain, P.K.(2000).CAD/CAM. S Chand & Company Pvt Ltd.
7. Ibraham,Z. (2009). CAD/CAM - Theory and Practice. Tata McGraw Hill Pub Co.

SEMESTER-VI

Course Title: TOTAL QUALITY MANAGEMENT
Course Code: BEE613

L	T	P	Credits
2	0	0	2

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

1. Analyze the Excellence in manufacturing/service, factors of excellence, relevance of TQM.
2. Recognize the concept of Quality.
3. Understand the Implication of Quality on Business.
4. Implement Quality Implementation Programs.
5. Exposure to challenges in Quality Improvement Programs.

Course Content

UNIT-I **5 Hours**

Quality and Total Quality Management: Excellence in manufacturing/service, factors of excellence, relevance of TQM.

Concept and definition of quality: total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM, Total Quality Management Models, benefits of TQM.

UNIT-II **9 Hours**

Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs. JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

Customer: Satisfaction, data collection and complaint, redressed mechanism.

Planning Process: Policy development and implementation; plan formulation and implementation.

UNIT-III **6 Hours**

Process Management: Factors affecting process management, Quality function development (QFD), and quality assurance system.

Total Employees Involvement (TEI): Empowering employees: team building; quality circles; Reward and Recognition; education and training, Suggestion schemes.

UNIT-IV **10 Hours**

Problems solving Defining problem; Problem identification and solving process; QC tools. Benchmarking definition, concept, process and types of benchmarking.

Quality Systems: Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003.

Advanced techniques of TQM: Design of experiments: failure mode effect analysis: Taguchi methods

Text/Reference Books:

1. Sunder, R. (2001). Total Quality Management. Tata McGraw Hill
2. Zairi M. (2000). TQM for Engineers. Aditya Books

SEMESTER-VI

Course Title: Computer Architecture
Course Code: BEE614

L	T	P	Credits
2	0	0	2

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

1. Ability to understand the fundamentals organization of computer system.
2. Ability to Identify, understand and apply different number systems, codes. Binary addition and subtraction, 1' & 2's complement representation and operations with this representation.
3. Ability to understand the digital representation of data in a computer system.
4. Ability to formulate the computer arithmetic operations and solve its problems.
5. Ability to examine the performance requirements of systems.

Course Content

UNIT-I **5 Hours**

BASIC STRUCTURE OF A COMPUTER SYSTEM

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

UNIT-II **10 Hours**

ARITHMETIC FOR COMPUTERS

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Sub word Parallelism

PROCESSOR AND CONTROL UNIT

A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT-III **10 Hours**

PARALLELISIM

Parallel processing challenges – Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT-IV **5 Hours**

MEMORY & I/O SYSTEMS

Memory Hierarchy – memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB‘s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits – USB.

Text/Reference Books:

1. David A. Patterson and John L. Hennessy.(2014). Computer Organization and Design: The Hardware/Software Interface, Fifth Edition. Morgan Kaufmann / Elsevier.
2. John P. Hayes. (2012). Computer Architecture and Organization, Third Edition. Tata McGraw Hill.
3. John L. Hennessey and David A. (2012). Patterson, Computer Architecture – A Quantitative Approach. Morgan Kaufmann / Elsevier Publishers, Fifth Edition.

SEMESTER-VI

Course Title: Estimating & Costing
Course Code: BEE615

L	T	P	Credits
2	0	0	2

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

1. Understand basic principles of estimating and costing.
2. Apply preliminary cost estimating techniques to prepare building cost plans.
3. Apply estimating techniques to build unit prices.
4. Learn price conforming Tenders to available information.
5. Develop and apply appropriate cost planning bidding strategies that are ethically appropriate.

Course Content

UNIT-I **5 Hours**

Introduction

Purpose of estimating and costing, preformed for making estimates, preparation of materials schedule, costing, price list, tender document, net price list, market survey, overhead charges, labour charges, electrical point method and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills. Tenders – its constituents, finalization, specimen tender.

UNIT-II **5 Hours**

Types of wiring

Cleat, batten, casing capping and conduit wiring, comparison of different wiring systems, selection and design of wiring schemes for particular situation (domestic and Industrial). Selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc. Use of wire-gauge and tables (to be prepared/arranged).

UNIT-III **10 Hours**

Estimating and Costing: Domestic installations;

Standard practice as per IS and IE rules. Planning of circuits, sub-circuits and position of different accessories, electrical layout, preparing estimates including cost as per schedule rate pattern and actual market rate (single storey and multi-storey buildings having similar electrical load)

Industrial installations:- relevant IE rules and IS standard practices, planning, designing and estimation of installation for single phase motors of different ratings, electrical circuit diagram, starters, preparation of list of materials, estimating and costing exercises on workshop with singe-phase, 3-phase motor load and the light load (3-phase supply system)

Service line connections: estimate for domestic and Industrial loads (over-head and underground connections) from pole to energy meter.

UNIT-IV **10 Hours**

Estimating the material required for:

Transmission and distribution lines (overhead and underground): Planning and designing of lines with different fixtures, earthing etc. based on unit cost calculations

Substation: Types of substations, substation schemes and components, estimate of 11/0.4 KV pole mounted substation up to 200 KVA rating, earthing of substations, Key Diagram of 66 KV/11KV Substation.

Text/Reference Books:

1. Gupta, J.B. (2000). Electrical Installation, Estimating and Costing. SK Kataria and Sons, New Delhi
2. Bhattacharya, S.K. (1998). Estimating and Costing. Tata McGraw Hill, New Delhi
3. Singh, Surjeet. (1999). Estimating and Costing. Dhanpat Rai & Co. New Delhi

SEMESTER-VII

Course Title: COMPUTER AIDED POWER SYSTEM ANALYSIS
Course Code: BEE701

L	T	P	Credits
3	0	0	3

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

1. Understand the computer applications in the analysis of power systems.
2. Understand the solution methods and techniques used in power system studies•
3. Analyze the behavior of power system under faulty conditions.
4. Gain the ability to critically analyze the solution methods used in power system studies.

Course Content

UNIT-I **10 Hours**

SYSTEM MODELLING:

System modeling of synchronous machines, transformers, loads etc, per unit impedance, single line diagram of electrical networks, single phase impedance diagrams corresponding to single line diagram. Formation of impedance and admittance matrices for the electrical networks.

UNIT-II **15 Hours**

LOAD FLOW STUDIES:

Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutions by the Gauss-Seidal Method & by Newton Raphson Method.

UNIT-III **10 Hours**

FAULT ANALYSIS:

Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers, Algorithm for short circuit studies, Symmetrical Component transformation, construction of sequence networks of power systems. Symmetrical Analysis of Unsymmetrical LG, LL, LLG faults using symmetrical components.

UNIT-IV **10 Hours**

POWER SYSTEM STABILITY:

Steady state stability, Dynamics of a synchronous machine, Power angle equations, Transient Stability, equal area criterion, Numerical solution of swing equation, factors effecting transient Stability.

Text/Reference Books:

1. Elgerd,O.I. (1999). Electric Energy Systems Theory. TMH
2. Nagrath,I.J. Kothari, D.P. (1998). Modern Power System Analysis. TMH
3. Stevenson, W.D. (2001). Elements of Power System Analysis. McGraw Hill
4. G.L.Kusic (1989) Computer Aided Power System Analysis, PHI.
5. John J. Grainger, William D. Stevenson, Jr., Power System Analysis, Tata McGraw-Hill Series in Electrical and Computer Engineering.
6. M. A. Pai (2005) Computer Techniques in Power Systems Analysis, Tata McGraw-Hill, Second edition.

SEMESTER-VII

Course Title: POWER SYSTEM PROTECTION
Course Code: BEE702

L	T	P	Credits
3	0	0	3

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

1. Calculate both symmetrical and un-symmetrical fault currents.
2. Understanding the fundamentals of electromechanical relays and digital protective relaying
3. The basic methods of calculating the magnitude and angle of voltage and current for the digital relaying
4. The methods to choose suitable current transformer, voltage transformer and circuit breakers etc for fulfilling power system protection
5. Design of over current protection and its coordination

Course Content

UNIT-I **10 Hours**

Introduction to Power System Protection:
Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.

Relay Construction and Operating Principles:
Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.

UNIT-II **10 Hours**

Overcurrent Protection:
Introduction, Time – current Characteristics, Current Setting, Time Setting. Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective

Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.

Distance Protection:
Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges (Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays.

UNIT-III **10 Hours**

Pilot Relaying Schemes:
Introduction, Wire Pilot Protection, Carrier Current Protection

Differential Protection:
Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.

Rotating Machines Protection:
Introduction, Protection of Generators.

Transformer and Buszone Protection:
Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection.

UNIT-IV **15 Hours**

Circuit Breakers:
Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF6 Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers.

Fuses:
Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination.

Protection against Over voltages:

Causes of Over voltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydono graph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL).

Text/Reference Books:

1. Elgerd O.L.(2001) Electrical Energy System Theory - An introduction, (TMH)
2. Stevenson Jr W.D.(1999) Elements of Power System Analysis, TMH
3. Wadhwa C.L. (2000) Course in Electrical Power, New Age Int.(P)Ltd.
4. Nagrath and Kothari,(2003) Power System Analysis, (TMH)
5. Gupta, B.R. (2001) Power System Analysis & Design, Wheeler Publishing.

SEMESTER-VII

Course Title: RESEARCH METHODOLOGY
Course Code: BEE703

L	T	P	Credits
3	0	0	3

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

1. To develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.
2. Have basic knowledge on qualitative research techniques.
3. Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis.
4. Have basic awareness of data analysis-and hypothesis testing procedures.
5. Justify multidisciplinary research and collaborate towards accomplishing common goal

Course Content

UNIT-I **10 Hours**

Research:
Objectives of Research, Research types, Research methodology, Research process – Flow chart, description of various steps, Selection of research problem.

Research Design
Meaning, Objectives and Strategies of research, different research designs, important experimental designs, completely randomized, randomized block, Latin Square, Factorial experimental design.

UNIT-II **10 Hours**

Methods of Data Collection and Presentation:
Types of data collection and classification, Observation method, Interview Method, Collection of data through Questionnaires, Schedules.

Probability Distributions
Discrete and Continuous probability distributions, Binomial, Poisson, Exponential, Normal, Frequency distribution, Cumulative Frequency distribution, Relative

Frequency distribution.

UNIT-III **10 Hours**

Sampling Methods:
Different methods of Sampling : Probability Sampling methods , Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling and Multistage Sampling. Non probability Sampling methods, Sample size.

Testing of Hypotheses:
Testing of Hypotheses concerning mean(s), Testing of Hypotheses concerning proportion (s),
Testing of Hypotheses concerning variance(s), Parametric tests (t, z and F), Chi Square test.

UNIT-IV **15 Hours**

Analysis of Data:
Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, Analysis of Variance, One - way ANOVA Correlation and Regression, Multiple Regression, Time series analysis, Factor Analysis, Centroid method. Computer simulations using MATLAB / SPSS

Report writing and Presentation:
Types of reports, Report Format – Cover page, Introductory page, Text, Bibliography, Appendices, Typing instructions, Oral Presentation.

Text/Reference Books:
1. Montgomery, Douglas C. (2007), Design and Analysis of Experiments, (Wiley India)
2. Kothari C.K. (2004), Research Methodology- Methods and Techniques (New Age International, New Delhi)

SEMESTER-VII

Course Title: MATLAB
Course Code: BEE704

L	T	P	Credits
0	0	2	1

Course Outcomes:

1. To learn features of MATLAB as a programming tool.
2. To promote new teaching model that will help to develop programming skills and technique to solve mathematical problems.
3. To understand MATLAB graphic feature and its applications.
4. To use MATLAB as a simulation tool.

Unit 1. Introduction to MATLAB — 09 Hours

- The MATLAB Environment
- MATLAB Basics – Variables, Numbers, Operators, Expressions, Input and output.
- Vectors, Arrays – Matrices

Unit 2. MATLAB Functions — 05 Hours

- Built-in Functions
- User defined Functions

Unit 3. Graphics with MATLAB — 05 Hours

- Files and File Management – Import/Export
- Basic 2D, 3D plots
- Graphic handling

Unit 4. Programming with MATLAB — 09 Hours

- Conditional Statements, Loops
- MATLAB Programs – Programming and Debugging.
- Applications of MATLAB Programming.

Unit 5. Mathematical Computing with MATLAB **07 Hours**

- Algebraic equations
- Basic Symbolic Calculus and Differential equations
- Numerical Techniques and Transforms

References:

1. “A Guide to MATLAB - for Beginners and Experienced Users”, 2nd ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press, (2006).

2. “Essentials of MATLAB Programming”, 2nd ed., Stephen J. Chapman, Cengage Learning, (2009).

3. “MATLAB Demystified”, David McMahon, The McGraw-Hill Companies, (2007).

4. “MATLAB® for Engineers”, 3rd ed., Holly Moore, Pearson Education, Inc., (2012).

5. “Engineering computation with MATLAB”, 2nd ed., David M. Smith, Pearson Education, Inc., (2010).

SEMESTER-VIII

Course Title: INTERNSHIP
Course Code: BEE801

L	T	P	Cr
0	0	0	20

Learning Outcome:

1. The capability to create, analyze and critically evaluate different technical/mechanical solutions.
2. A consciousness of the ethical aspects of research and development work.
3. The capability to critically and systematically integrate knowledge.

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

Course Content

Industrial Training aims at exposing the students to field practices, size and scale of operation and work culture at practical sites.
Each student is supposed to study the material and technology used at site and prepares a detailed report of the observation of process seen by him/her.
The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following.

a) Punctuality and regularity 15%
b) Initiative in learning new things 15%
c) Relationship with workers 15%
d) Industrial training report 55%