Curriculum Structure & Syllabi

of

B. Tech

In

ELECTRICAL ENGINEERING DEPARTMENT

(w.e.f. 2014-15)

Vision

Mission

Program Educational Objectives

Program Outcomes

Program Specific Outcomes

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF ELECTRICAL ENGINEERING

M. M. M. UNIVERSITY OF TECHNOLOGY,

GORAKHPUR-273010, UP

August 2021

Department of Electrical Engineering

CURRICULA & SYLLABI

B. Tech. Electrical Engineering

Vision:

To develop intellectual potentials with excellence in electrical engineering & technology for the global needs.

Mission:

1. Empowering students with state-of-art knowledge, technological skills & ethics.
2. Provide research environment for sustainable technical growth in the area of power and energy.
3. Providing effective solutions for industries through research and consultancy.
4. Exposure to standard electrical safety measures and practices.
5. Encourage new and non-conventional energy technology for sustainable development and environmental stewardship.

Programme Educational Objectives (PEO)

1. To provide technical knowledge in electrical engineering to excel in electrical utility & services.
2. To nurture the students to become successful engineer with administrative acumen to ethically handle the critical situations timely.
3. To prepare and motivate the students for higher education, research, and continuous learning in multi-disciplinary areas with innovative ideas for sustainable development.

Programme Outcome (POs)

Students will demonstrate the ability to-

1. Apply the knowledge of mathematics, science, and Engineering in all aspects of Electrical Engineering.
2. To formulate the techniques of using appropriate tools to analyze and/or fabricate electrical systems.
3. Design of different parts of electrical machines, drives &power system network.
4. Align with and upgrade to higher learning and research activities.
5. Model real life problems using different hardware and software platforms, both offline and in real-time.

6. Possess an appreciation of professional, societal, environmental, and ethical issues and proper use of renewable resources.
7. Develop the awareness about non-conventional sources of energy for sustainable development.
8. Promote the good practices of electrical engineering with high ethical values.
9. Work in a team and comprehend his/her scope of work, deliverables and issues in which help is needed by other members of the team.
10. To communicate effectively and to prepare formal technical plans leading to solutions and detailed reports for electrical systems.
11. To be familiar with project management problems and basic financial principles for a multi-disciplinary work such as biomedical instrumentation.
12. A recognition of the need for identifying contemporary issues due to changing technical scenario and an ability to engage in life-long learning to update himself/herself.

Programme Specific Outcome (PSOs)

1. Apply the fundamentals of mathematics, science, and engineering knowledge to identify, formulate, design, and investigate complex engineering problems of electrical circuits, control systems, electrical machines, and power system.
2. Apply the appropriate techniques and modern engineering hardware and software tools in electrical engineering to engage in life-long learning and to successfully adapt in multi-disciplinary environments.
3. Aware of the impact of professional engineering solutions in societal, environmental context, professional ethics and be able to communicate effectively.

Syllabus and Credit structure

Credit structure

Freshman Year, Semester-I

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	BSM	BMS-01/ BAS-01	Engineering Mathematics-I	3	1	0	4
2.	BSM	BPM-01/ BAS-02	Engineering Physics-I	3	1	2	5
3.	EF	BEE-02	Electrical Circuits and Analysis	3	1	2	5
4.	EF	BEC-01	Fundamentals of Electronics Engineering	3	1	2	5
5.	BSM	BCY-01/ BAS-09	Engineering Chemistry	3	1	2	5
6.	EF	BME-10	Workshop Technology	0	0	4	2
7.	AC		Audit Course				-
			Total	**15**	**5**	**12**	**26**

Freshman Year, Semester-II

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	BSM	BMS-02/ BAS-07	Engineering Mathematics-II	3	1	0	4
2.	BSM	BPM-02/ BAS-08	Engineering Physics-II	3	1	2	5
3.	HSSC	BHM-01/ BAS-03	Professional Communication	3	1	0	4
4.	EF	BME-02	Fundamentals of Mechanical Engineering	3	1	2	5
5.	HSSE	BHM-04/ BAS-11	Human Values & Professional Ethics	2	1	0	3
6.	EF	BCE-10	Engineering Graphics	0	0	4	2
7.	AC		Audit Course				-
			Total	**14**	**5**	**8**	**23**

Sophomore Year, Semester-III

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	BSM	BMS-04/ BAS-21	Engineering Mathematics-III	3	1	0	4
2.	BSM	BME-15	Engineering Materials	3	1	2	5
3.	EF	BEC-12	Digital Electronics and Circuits	3	1	2	5
4.	DC	BEE-11	Basic System Analysis	3	1	0	4
5.	DC	BEE-12	Electrical Measurement & Measuring Instruments	3	1	2	5
6.	EF	BEE-20A	Simulation Techniques	0	0	6	3
7.	AC		Audit Course				-
			Total	**15**	**5**	**12**	**26**

Sophomore Year, Semester-IV

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	BSM	BMS-08/ BAS-23	Engineering Mathematics-IV	3	1	0	4
2.	M	MBA-01	Industrial Management	2	1	0	3
3.	DC	BEE-13	Electromechanical Energy Conversion-I	3	1	2	5
4.	DC	BEE-14A	Network Analysis and Synthesis	3	1	2	5
5.	DC	BEE-15A	Microprocessor: Architecture, Programming & Interfacing	3	1	2	5
6.	EF	BHM-03/ BAS-20	Communication Skills	0	0	4	2
7.	AC		Audit Course				-
			Total	**14**	**5**	**10**	**24**

Junior Year, Semester-V

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	M	MBA-02	Engineering and Managerial Economics	2	1	0	3

2.	DC	BEE-26	Electromechanical Energy Conversion-II	3	1	2	5
3.	DC	BEE-27	Power System- I	3	1	0	4
4.	DC	BEE-28	Control System Engineering	3	1	2	5
5.	PE1	BEE-**	Programme Elective-1	3	1	0/2	4/5
6.	AC		Audit Course				-
			Total	**14**	**5**	**4/6**	**21/22**

Junior Year, Semester-VI

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	DC	BEE-29	Instrumentation & Process Control	3	1	2	5
2.	DC	BEE-31	Power System- II	3	1	2	5
3.	DC	BEE-32A	Power Electronics	3	1	2	5
4.	DC	BEE-33	Power Plant Engineering	3	1	0	4
5.	PE2	BEE-**	Programme Elective-2	3	1	0/2	4/5
6.	AC	BEE-30	Seminar	0	0	6	-
			Total	**15**	**5**	**6/8**	**23/24**

Senior Year, Semester-VII

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	DC	BEE-42	Switch Gear & Protection	3	1	2	5
2.	DC	BEE-43	Power System Operation and Control	3	1	0	4
3.	DC	BEE-44	Utilization & Traction	3	1	0	4
4.	PE3	BEE-**	Programme Elective-3	3	1	0/2	4/5
5.	P	BEE-40	Project Part –I	0	0	10	5
6.	AC	BEE-45	Industrial/Practical Training	0	0	2	-
			Total	**12**	**4**	**14/ 16**	**22/23**

Senior Year, Semester-VIII

S.N.	Category	Paper Code	Subject	L	T	P	Credits
1.	DC	BEE-41	Electric Drives	3	1	2	5
2.	DC	BEE-46	Power Quality	3	1	0	4
3.	PE4	BEE-**	Programme Elective-4	3	1	0	4
4.	OE	BOE**	Open Elective	3	1	0	4
5.	P	BEE-50	Project Part- II	0	0	10	5
			Total	**12**	**4**	**12**	**22**

Engineering Fundamentals & Department Core (Electrical Engineering)

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
		Year I					
1.	BEE-02	Electrical Circuits and Analysis	-	3	1	2	5
		Year II					
2.	BEE-11	Basic System Analysis	-	3	1	0	4
3.	BEE-12	Electrical Measurement & Measuring	-	3	1	2	5

		Instruments					
4.	BEE-13	Electromechanical Energy Conversion-I	-	3	1	2	5
5.	BEE-14A	Network Analysis and Synthesis	-	3	1	2	5
6.	BEE-15A	Microprocessor: Architecture, Programming & Interfacing	-	3	1	2	5
7.	BEE-20A	Simulation Techniques	-	0	0	4	2
		Year III					
8.	BEE-26	Electromechanical Energy Conversion-II	-	3	1	2	5
9.	BEE-27	Power System- I	-	3	1	0	4
10.	BEE-28	Control System Engineering	-	3	1	2	5
11.	BEE-29	Instrumentation & Process Control	-	3	1	2	5
12.	BEE-31	Power System- II	-	3	1	2	5
13.	BEE-32A	Power Electronics	-	3	1	2	5
14.	BEE-33	Power Plant Engineering	-	3	1	0	4
15.	BEE-30	Seminar	-	0	0	6	3
		Year IV					
16.	BEE-41	Electric Drives	BEE-32	3	1	2	5
17.	BEE-42	Switch Gear & Protection	-	3	1	2	5
18.	BEE-43	Power System Operation and Control	-	3	1	0	4
19.	BEE-44	Utilization & Traction	-	3	1	0	4
20.	BEE-46	Power Quality	-	3	1	0	4
21.	BEE-40	Project Part-I	-	0	0	10	5
22.	BEE-45	Industrial/Practical Training	-	0	0	2	1
23.	BEE-50	Project Part-II	BEE-40	0	0	10	5

Programme Electives (Electrical Engineering)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
	PE1 for V Semester						
1.	BCS-36	Database Management System, Data Mining and Warehousing	-	3	1	0	4
2.	BCS-37	Network Security &Cryptography	-	3	1	2	5
3.	BEC-42	Digital Signal Processing	BEC-13	3	1	0	4
4.	BEC-14	Electromagnetic Field Theory	-	3	1	0	4
	PE2 for VI Semester						
5.	BEE-51	High Voltage Engineering	-	3	1	0	4
6.	BEE-52	Intelligent Instrumentation	BEE-29	3	1	0	4
7.	BEE-53	Digital Control System	-	3	1	0	4
8.	BEE-54	Conventional and CAD of Electrical Machines	-	3	1	2	5
	PE3 for VII Semester						
9.	BCS-44/ BCS-13	Object Oriented Techniques and JAWA Programming	-	3	1	0	4
10.	BEC-28	Principle of Communication	BEC-13	3	1	2	5
11.	BEE-55	EHV AC & DC Transmission	-	3	1	0	4
12.	BEE-56	Advanced Microprocessors and Micro Controllers	BEE-15	3	1	2	5
	PE4 for VIII Semester						

13.	BEE-57	Modern Control System	BEE-28	3	1	0	4
14.	BEE-58	SCADA & Energy Management System	-	3	1	0	4
15.	BEE-59	Energy Efficiency & Conservation	-	3	1	0	4
16.	BEE-60	Bio Instrumentation	-	3	1	0	4

Subjects offered to other departments

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	BEE-01	Principles of Electrical Engineering	-	3	1	2	5
2.	BEE-16	Electromechanical Energy Conversion	-	3	1	2	5
3.	BOE-10	Non-Conventional Energy Resources	-	2	1	0	3
4.	BOE-11	Fundamentals of Electric Drives	-	2	1	0	3

Audit Courses for B. Tech. (Electrical Engineering)

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
		Year-I					
1.	BCY-04/ BAS-05	Environment & Ecology	-	2	1	0	3
2.	BCS-01	Introduction to Computer Programming	-	2	1	2	4
3.	BPM-03/ BAS-06	Space Sciences	-	2	1	0	3
		Year-II					
4.	BPM-04/ BAS-22	Nano Technology	-	2	1	0	3
5.	BCS-33	Web Technologies	-	3	1	2	5
6.	MHM-104/ MAS-109	Foreign Language-French	-	2	1	0	3
7.	MHM-105/ MAS-110	Foreign Language-German	-	2	1	0	3
8.	MHM-106/ MAS-111	Foreign Language-Spanish	-	2	1	0	3
9.	BAS-13	Industrial Sociology	-	2	1	0	3
10.	MBA-151	Advanced Professional Writing	-	3	1	0	4
		Year-III					
11.	BCS-73/ BCS-69	Neural Network & Fuzzy Systems	-	3	1	0	4
12.	BCS-15	Database Management System	-	3	1	2	5

Subjects Offered by the Department

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	BEE-01	Principles of Electrical Engineering	-	3	1	2	5
2.	BEE-02	Electrical Circuits and Analysis	-	3	1	2	5
3.	BEE-11	Basic System Analysis	-	3	1	0	4
4.	BEE-12	Electrical Measurement & Measuring	-	3	1	2	5

		Instruments					
5.	BEE-13	Electromechanical Energy Conversion-I	-	3	1	2	5
6.	BEE-14A	Network Analysis and Synthesis	-	3	1	2	5
7.	BEE-15A	Microprocessor: Architecture, Programming & Interfacing	-	3	1	2	5
8.	BEE-16	Electromechanical Energy Conversion	-	3	1	2	5
9.	BEE-20A	Simulation Techniques	-	0	0	6	3
10.	BEE-26	Electromechanical Energy Conversion-II	-	3	1	2	5
11.	BEE-27	Power System- I	-	3	1	0	4
12.	BEE-28	Control System Engineering	-	3	1	2	5
13.	BEE-29	Instrumentation & Process Control	-	3	1	2	5
14.	BEE-31	Power System- II	-	3	1	2	5
15.	BEE-32A	Power Electronics	-	3	1	2	5
16.	BEE-33	Power Plant Engineering	-	3	1	0	4
17.	BEE-30	Seminar	-	0	0	6	3
18.	BEE-41	Electric Drives	BEE-32	3	1	2	5
19.	BEE-42	Switch Gear & Protection	-	3	1	2	5
20.	BEE-43	Power System Operation and Control	-	3	1	0	4
21.	BEE-44	Utilization & Traction	-	3	1	0	4
22.	BEE-46	Power Quality	-	3	1	0	4
23.	BEE-40	Project Part-I	-	0	0	10	5
24.	BEE-45	Industrial/Practical Training	-	0	0	2	1
25.	BEE-50	Project Part-II	BEE-40	0	0	10	5
26.	BEE-51	High Voltage Engineering	-	3	1	0	4
27.	BEE-52	Intelligent Instrumentation	BEE-29	3	1	0	4
28.	BEE-53	Digital Control System	-	3	1	0	4
29.	BEE-54	Conventional and CAD of Electrical Machines	-	3	1	2	5
30.	BEE-55	EHV AC & DC Transmission	-	3	1	0	4
31.	BEE-56	Advanced Microprocessors and Micro Controllers	BEE-15	3	1	2	5
32.	BEE-57	Modern Control System	BEE-28	3	1	0	4
33.	BEE-58	SCADA & Energy Management System	-	3	1	0	4
34.	BEE-59	Energy Efficiency & Conservation	-	3	1	0	4
35.	BEE-60	Bio Instrumentation	-	3	1	0	4

SYLLABI

BMS-01/BAS-01 ENGINEERING MATHEMATICS-I

Course category: Basic Sciences & Maths (BSM)

Pre-requisite Subject: NIL

Contact hours/week: Lecture: 3, Tutorial: 1, Practical: 0

Number of Credits: 4

Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of basic differential operators in various engineering problems.
2. Solve linear system of equations using matrix algebra.
3. Use vectors to solve problems involving force, velocity, work and real-life problems and able to analyse vectors in space
4. Evaluate and use double integral to find area of a plane region and us of triple integral to find the volume of region in 3rd dimension

Topics Covered

UNIT-I **9L**

Differential Calculus: Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables. Digital Display Devices: LED, LCD, Gas Discharge Plasma Displays, Incandescent Display, LVD (Liquid Vapour Display), Printers, Digital Voltmeters, Spectrum Analyzer.

UNIT-II **9L**

Linear Algebra: Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution. Characteristic equation, Eigenvalues, Eigen-vectors, Cayley-Hamilton theorem.

UNIT-III **9L**

Multiple Integrals: Double and triple integrals, change of order of integration, change of variables. Application of multiple integral to surface area and volume. Beta and Gamma functions, Dirichlet integral.

UNIT-IV **9L**

Vector Calculus: Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers.

2. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi.
3. H.K. Dass and Rama Verma: Engineering Mathematics; S. Chand Publications.
4. N.P. Bali and Manish Goel: Engineering Mathematics; Laxmi Publications.

BPM-01/BAS-02 ENGINEERING PHYSICS-I

Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basics of relativity and its application in Engineering.
2. Quantum Mechanics and its application to understand material properties.
3. Statistical mechanics and its application in study of Macro and Micro scale properties of Matter.
4. Use of the principle of optics in the measurement.
5. Applications of Laser and holography in Engineering.
6. Basic Principles of optical Fibre and its application in Engineering

Topics Covered

UNIT-I **9L**

Relativistic Mechanics: Inertial and Non-inertial Frames of reference, Galilean transformation, Michelson-Morley Experiment, Postulates of special theory of relativity, Lorentz Transformation, Length contraction, Evidences of length contraction, Time dilation, Evidences for time dilation, Relativistic velocity transformation, Relativistic variation of mass with velocity, Evidence of mass variation with velocity, Relativistic kinetic energy, Mass energy equivalence, Examples from nuclear physics, Relativistic energy-momentum relation.

UNIT-II **9L**

Quantum Mechanics: De Broglie waves and Group velocity concept, Uncertainty principle and its application, Davisson-Germer experiment, Derivation of Schrodinger equation for time independent and time dependent cases. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a free particle (one dimensional and three-dimensional case), Particle in a box (one dimensional), Simple harmonic oscillator (one dimensional).

UNIT-III **9L**

Physical Optics:
Interference: Interference of light, Interference in thin films (parallel and wedge-shaped film), Newton's rings. Refractive index and wavelength determination.
Diffraction: Single, double, and N- Slit Diffraction, Diffraction grating, grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.
Polarization: Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate, Polarimeter

UNIT-IV **9L**

Modern Optics
Laser: Spontaneous and stimulated emission of radiation, population inversion, concept of 3 and 4 level Laser, construction and working of Ruby, He-Ne lasers, and laser applications.
Fiber Optics: Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone, Numerical aperture, Propagation Mechanism, and communication in fiber Single and Multi-Mode Fibers, step index and graded index fiber.
Holography: Basic Principle of Holography, Construction, and reconstruction of Image on hologram and applications of holography.

EXPERIMENTS

1. To determine the wavelength of monochromatic light by Newton's Ring
2. To determine the specific rotation of cane sugar solution using polarimeter
3. To determine the wavelength of spectral lines using plane transmission grating.
4. To verify Brewster's law using rotating Nicol prism
5. To verify Stefan's law by electrical method
6. To Study resonance in LCR circuit with a c source.
7. To determine the height of a tower with a Sextant.
8. To determine the refractive index of a liquid by Newton's ring.

Books & References

1. *Introduction to Special* theory Relativity-*Robert* Resnick, Wiley Eastern Ltd.
2. Statistical Mechanics and Properties of Matter- *E S R Gopal,* John Wiley, and Sons
3. Quantum Mechanics: Theory and Applications- Ajoy Ghatak, *Tata McGraw-Hill*
4. *Optics*- Ajoy Ghatak, *Tata McGraw-Hill*
5. *Optics*- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand

6. *Fiber optics and laser* Principles and Applications-Anuradha De, *New Age* International
7. Concepts of Modern Physics-Arthur Beiser, *Tata McGraw-Hill*

BEE-02 ELECTRICAL CIRCUITS AND ANALYSIS

Course category:	Engineering Fundamentals (EF)
Pre-requisite Subject:	Physics and Math (10+2)
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to understand the basic concepts of network and circuit.
2. To solve the basic electrical circuits.
3. Familiarity with the basic concepts of AC circuits.
4. Able to analyse the transient behaviour of the circuit.
5. Able solve magnetic circuits.
6. Able to analyse three phase circuits.
7. Need of earthing of equipment's with safety issues.

Topics Covered

UNIT-I **9L**

D C Circuit Analysis and Network Theorems:
Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation Kirchhoff's laws; Loop and nodal methods of analysis; Star-delta transformation Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem

UNIT-II **9L**

Analysis of Single-Phase AC Circuits:
Complex quantities, the operator J, Representation of vectors, forms of expression of complex quantities, complex expression of voltage , current and impedance, addition and subtraction of Steady State , AC fundamentals, Sinusoidal, square and triangular waveforms, Average

and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series parallel RLC Circuits, Resonance in series and parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Causes and problems of low power factor, Concept of power factor improvement.

UNIT-III **9L**

Transient State Analysis:
Transient response of series RL circuit with alternating voltage source, Transient Response Analysis of series RC circuit, Transient Response Analysis of series RLC circuit.
Non sinusoidal waves: generation of non- sinusoidal waves, Fourier analysis, constants in Fourier series, Effective values of complex wave, power and power factor.
Need of Earthing of equipment and devices, important electrical safety issues

UNIT-IV **9L**

Three Phase AC Circuits:
Three phase system its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, three phase power.
Magnetic Circuit: Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Mutual coupling with dot convention, Magnetic circuit calculations, Mutual inductance coupling coefficient.

EXPERIMENTS

1. Verification of Kirchhoff's law
2. Verification of Norton's theorem
3. Verification of Thevenin's theorem
4. Verification of Superposition theorem
5. Verification of Series R-L-C circuit
6. Verification of Parallel R-L-C circuit
7. Study of R-L-C series resonant circuit
8. Study of R-L-C Parallel resonant circuit

Books & References

1. K. S. Suresh Kumar: Electrical Circuit Analysis. Pearson, 2013
2. Lawrence P. Huelsman 'Basic Circuit Theory", 3rd ed. PHI
3. T. K. Nagsakar & M.S. Sukhija "Basic Electrical Engineering," OXFORD, 2nd ed.
4. Samarjit Ghosh, 'Network Theory: Analysis and Synthesis' PHI.

BEC-01 FUNDAMENTALS OF ELECTRONICS ENGINEERING

Course category: Engineering Fundamentals (EF)

Pre-requisite Subject: NIL

Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to identify schematic symbols and understand the working principles of electronic devices, e.g., Diode, Zener Diode, LED, BJT, JFET and MOSFET etc.
2. Able to understand the working principles of electronic circuits e.g., Rectifiers, Clipper, Clamper, Filters, Amplifiers and Operational Amplifiers etc. also understand methods to analyse and characterize these circuits
3. Able to understand the functioning and purposes of Power Supplies, Test and Measuring equipment's such as multimeters, CROs and function generators etc.
4. Able to rig up and test small electronics circuits.

Topics Covered

UNIT-I **9L**

Semiconductor materials and properties: electron-hole concepts, Basic concepts of energy bands in materials, concept of forbidden gap, Intrinsic and extrinsic semiconductors, donors and acceptors impurities, Junction diode, p-n junction, depletion layer, v-i characteristics, diode resistance, capacitance, diode ratings (average current, repetitive peak current, non-repetitive current, peak inverse voltage). Diode Applications in rectifier, filters, voltage multipliers, load regulators, clipper and clamper circuits, Breakdown mechanism (Zener and avalanche), breakdown characteristics, Zener resistance, Zener diode ratings, Zener diode application as shunt regulator

UNIT-II **9L**

Bipolar Junction Transistor (BJT): Basic construction, transistor action, CB, CE and CC configurations, input/output characteristics, Biasing of transistors-fixed bias, emitter bias, potential divider bias, comparison of biasing circuits. Transistor Amplifier: Graphical analysis of CE amplifier, concept of voltage gain, current gain, h- parameter model (low frequency), computation of Ai, Av, Ri, Ro of single transistor CE and CC amplifier configurations.

UNIT-III **9L**

MOSFET: depletion and enhancement type MOSFET-construction, operation and characteristics. Computation of Av, Ri, Ro, of single FET amplifiers using all the three configurations.
Operational Amplifiers: Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers, integrators equation CG, CS and CD configurations, fixed & self-biasing.

UNIT-IV **9L**

Switching theory and logic design: Number systems, conversion of bases, Boolean algebra, logic gates, concept of universal gate, canonical forms, Minimization using K-map Operational Amplifiers

Electronics Instruments: Working principle of digital voltmeter, digital multimeter (block diagram approach), CRO (its working with block diagram), measurement of voltage, current, phase and frequency using CRO

EXPERIMENTS

A. Compulsory Experiments

1. To identify the components which are used in electronic circuits.
2. To get familiarization and to study the operation of a function generator instrument and visualize the types of waveforms produced by a function generator.
3. To study the CRO and to find the Amplitude and Frequency of a sinusoidal waveform using CRO.
4. To plot and analyze the forward and Reverse Characteristics of Si based P-N junction diode.
5. To implement a circuit to study the various applications of Operational Amplifier.
6. Study of half wave rectifier.
7. Operation of diode-based clipper and clamper circuits.

B. Optional Experiments

1. Implement a circuit to draw the characteristics of JFET in common source configuration.
2. Implement a circuit of half wave and full wave rectifiers with filters.
3. Implement a circuit to draw the characteristics of common emitter BJT amplifier.

Books & References

1. Electronic Devices and Circuits-Boylestad and Nashelsky, 6e, PHI, 2001.
2. Electronic Devices and Circuits, A Mottershead, PHI, 2000, 6e.
3. Digital Computer Design, Morris Mano, PHI, 2003.

4. Electronic Instrumentation-H.S. Kalsi, 2e, TMH, 2007.

BCY-01/BAS-09 ENGINEERING CHEMISTRY

Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Engineering Chemistry, which allows students to gain qualitative and quantitative skills.
2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level.
3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry.
4. Students will acquire practical knowledge and will be able to analyze data constructively and formulate new ideas.

Topics Covered

UNIT-I **9L**

Molecular orbital theory, LCAO approximation, MO diagrams of diatomic molecules. Band theory of metallic bond, Hydrogen bonding, Structure of graphite and fullerene- C60, Liquid crystallite state, classification and applications of liquid crystals, Types of unit cell, space lattice (only cubes), Bragg's Law, Calculation and density of the cubic unit cell, Phase Rule and its application to water system.

UNIT-II **9L**

Inductive, mesomeric and hyperconjugative effects, Stability of reactive intermediates, e.g. Carbocation, Carbanion and free radicals, Types of organic reactions, & Mechanism of nucleophilic substitution & elimination reactions, Mechanism of organic name reactions (Cannizzaro reaction, Aldol condensation, Beckmann rearrangement, Hoffmann rearrangement & Diels Alder Reaction) Stereosomerism of organic compounds containing one & two chiral centers. Enantiomers & diastereomers, R-S & E-Z Nomenclature, Examples of optically active compounds without chiral centre, Conformations of butane

UNIT-III **9L**

Introduction & classification of polymers, Chain and Step growth polymerization, Thermoplastic and Thermosetting resins, Elastomers and synthetic fibres, Mechanism of chain polymerization, Stereoregular polymers, Synthesis, and applications of: Polyethylene, Poly propylene, PVC, PMMA, PAN, PET, Polyamides, Polyurethane, Natural and synthetic Rubbers, Phenol Formaldehyde Resin. Conducting & biodegradable polymers and their applications Cement and its applications

Classification of Fuels, calorific value of fuel, gross & net calorific value, determination of calorific value using Bomb calorimeter

UNIT-IV **9L**

Basic principles of spectroscopic methods, Basic principles of UV-Visible, IR, ^{1}H NMR & Mass spectroscopy, determination of structure of simple organic compounds.

Hardness of water, Softening of water (Zeolite process, Lime Soda process & Ion exchange process). Treatment of boiler feed water by Calgon process

EXPERIMENTS

1. Determination of iron content in the given sample using $K_3[Fe(CN)_6]$ as an external indicator.
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Determination of alkalinity in the given water sample.
4. Determination of chloride content in the given water sample by Mohr's method.
5. Determination of percentage of available chlorine in bleaching powder sample.
6. pH-metric titration between strong acid and strong base.
7. Viscosity of a polymer like polystyrene by Viscometric method.
8. Element detection & functional group identification in organic compounds
9. Preparation of a polymer like Bakelite or PMMA.
10. Preparation of Sodium Cobaltinitrite salt.

Books & References

1. Environmental Studies - J Krishnawamy , R J Ranjit Daniels, Wiley India
2. Environmental Science - Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall
3. Environment and Ecology - R K Khandal, 978-81-265-4277-2, Wiley India
4. Environmental Science – 8th edition ISV, Botkin and Keller, 9788126534142, Wiley India
5. Environmental Studies - Soli. J Arceivala, Shyam, R Asolekar, McGrawHill India, 2012
6. Environmental Studies - D.L. Manjunath, 9788131709122 Pearson Education India, 2007

BME-10 WORKSHOP TECHNOLOGY

Course category:	Engineering Fundamentals (EF)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 4
Number of Credits:	2
Course Assessment methods:	Continuous assessment through viva-voice, Practical work/record, attendance, and Major Practical Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the importance, materials, applications and safety in different shops for thedevelopment of a product/component.
2. The knowledge of tools and processes used in carpentry and foundry shops for thedevelopment of products through casting process.
3. The knowledge of forming process will develop skills for producing products using different tools and processes in black smithy and sheet metal shops.
4. The knowledge of tools and processes in machine shop and welding shop will developability of producing different products.

Topics Covered

Note: Make at least one job in each shop

1. **Introduction**
   - Need and importance of workshop
   - Mechanical properties of metals
   - Ferrous Metals and alloys- composition and applications
   - Non-Ferrous Metals and alloys- composition and applications
   - Safety in each shop
2. **Carpentry Shop:**
   - Draw layout of carpentry shop
   - Study of tools & operations and carpentry joints.
   - Preparation of half-lap corner joint, mortise & tennon joint
   - Simple exercise on woodworking lathe
3. **Fitting Shop:**
   - Layout of fitting shop
   - Study of tools & operations
   - Simple exercises involving fitting work.
   - Simple exercises involving drilling/tapping/die

4. **Black Smithy Shop:**
   - Layout of Smithy Shop
   - Study of tools & operations
   - Hot and cold working
   - Simple exercises base on black smithy operations such as upsetting, drawing down, punching,bending, fullering & swaging.
5. **Welding Shop:**
   - Layout of welding shop
   - Study of equipment of gas welding & arc welding
   - Preparation of simple butt and lap welded joints.
   - Oxy-acetylene flame cutting
6. **Sheet-metal Shop**

BMS-02/BAS-07 ENGINEERING MATHEMATICS-II

Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various mathematical techniques such as differential operators, matrix algebra and vector differentiation and integration.
2. To identify, formulate and solve the real-life problems.
3. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I **9L**

Differential Equations: Linear differential equations with constant coefficients ($n^{th} order$), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

UNIT-II **9L**

Special functions: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials

UNIT-III **9L**

Laplace Transform: Laplace Transform, Laplace transform of derivatives and integrals. Unit step function, Laplace transform of Periodic function. Inverse Laplace transform, Convolution theorem, Applications to solve simple linear and simultaneous differential equations.

UNIT-IV **9L**

Fourier Series and Partial Differential Equations: Periodic Functions, Fourier Series of period 2π, Change of interval, Even and Odd functions, Half range Sine and Cosine Series. Harmonic analysis, Partial Differential Equations with constant coefficients.

Books & References

1. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers
2. Engineering Mathematics - H.K. Dass and Rama Verma, S. Chand Publications
3. Engineering Mathematics - N.P. Bali and Manish Goel, Laxmi Publications
4. Higher Engineering Mathematics - B.V. Ramana, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

BPM-02/BAS-08 ENGINEERING PHYSICS-II

Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basics of crystallography application in Engineering
2. Use of the principles of sound wave and acoustics in civil engineering with the consideration of NDT.
3. Basic principles of electricity and magnetism applied in Engineering.

4. Maxwell's equation of electromagnetic theory and its application in engineering.
5. Basic principles of semiconducting materials and its application.
6. Basic Principles of Superconductivity and its application in Engineering.

Topics Covered

UNIT-I **9L**

Crystal Structures and X-ray Diffraction: Space lattice, basis, Unit cell, Lattice parameter, seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer.

UNIT-II **9L**

Sound Waves and Acoustics: Sound waves, intensity, loudness, reflection of sound, echo; Reverberation, reverberation time, Sabine's formula, remedies over reverberation; Absorption of sound, absorbent materials; Conditions for good acoustics of a building; Noise, its effects and remedies; Ultrasonics –Production of ultrasonics by Piezo-electric and magnetostriction; Detection of ultrasonics; Engineering applications of Ultrasonics (Non-destructive testing).

UNIT-III **9L**

Electrodynamics –I: Basic concepts of Gauss's law, Ampere's law and faradays law of electromagnetic induction. Correction of Ampere's law by Maxwell (concept of displacement current), Maxwell's equation, transformation from integral form to differential form, physical significance of each equation

Electrodynamics –II: Maxwell's equation in free space, velocity of electromagnetic wave, transverse character of the wave and orthogonality of E, H and k vectors, Maxwell's equations in dielectric medium and velocity of e. m. wave, comparison with free space, Maxwell's equations in conducting media, solution of differential equation in this case and derivation of penetration depth

UNIT-IV **9L**

Physics of Advanced Materials

Semiconducting Materials: Concept of energy bands in solids, Carrier concentration and conductivity in intrinsic semiconductors and their temperature dependence, carrier concentration and conductivity in extrinsic semiconductors and their temperature dependence. Hall effect in semiconductors, Compound semiconductors, Optoelectronic Materials.

Superconducting Materials: Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, Type- I and Type-II superconductors, Electrodynamics of superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Superconductors.

Nano-Materials: Basic principle of nanoscience and technology, structure, properties and uses of Fullerene and Carbon nanotubes, Applications of nanotechnology.

EXPERIMENTS

1. To determine the specific resistance of a given wire using Carrey Foster's Bridge.
2. To study the variation of magnetic field along the axis of current carrying circular coil.
3. To study the Hall's effect and to determine Hall coefficient in n type Germanium.
4. To study the energy band gap of n- type Germanium using four probe methods
5. To determine e/m of electron using Magnetron valve
6. To draw hysteresis curve of a given sample of ferromagnetic material
7. To determine the velocity of Ultrasonic waves
8. To determine the Elastic constants (Y, η, σ) by Searl's method.

Books & References

1. Introduction to Solid State Physics- Kittel, 7th edition, Wiley Eastern Ltd.
2. Solid State Physics - S. O. Pillai, 5th edition, New Age International.
3. Introduction to Electrodynamics- David J. Griffiths Pearson, New International edition
4. Semiconductor Devices and Application - S.M. Sze, Wiley
5. Introduction to Nano Technology - Poole Owens, Wiley India
6. Master Handbook of Acoustics - F. Alton Everest and Ken Pohlmann, 5th edition, McGraw Hill

BHM-01/BAS-03 PROFESSIONAL COMMUNICATION

Course category:	Humanities & Social Science Core (HSSC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of communication skills, such as, Reading, Writing, Listening, and speaking skills.
2. To identify, formulate and solve the real-life problems with positive attitude.

3. To inculcate the habit of learning and developing the communication and soft skills bypractice.

Topics Covered

UNIT-I **9L**

Communication

Principles of Communication – Communication as coding and decoding – signs and symbols – verbal and non –verbal symbols – Language AND communication; language VS communication, language as a tool of communication – media/channels for communication **:** Types of Communication- functional, situational, verbal and non-verbal, interpersonal, group, interactive, public, mass line, dyadic – with illustrations LSRW in Communication – Listening – active vs passive (Talk less, listen more); Speaking - Speech vs. enunciation (mind your tone); Reading – Focus on the structure not on the theme alone, Technical Communication, General Communication, Barriers of Communication, Levels of Communication

UNIT-II **9L**

Language Acquisition through Grammar, Usage and Mechanics of Writing

Vocabulary, Phrase, Clause, Parts of Speech: Types ,Examples with Use Gender, Singular, Plural, Article, Sequence of Tenses, Use of Modifiers, Sentence-Loose Sentence, Periodical Sentence, Topic Sentence, Paragraph-Different Orders and Methods of Paragraph Writing, Inductive Method, Deductive Method, Spatial Method, Question and Answer Method, Chronological Method, Expository Method, Common Errors, Antonyms, Synonyms, One- word Substitutes, Homophone, Homonym, Comprehension and Précis, Words Frequently Misspelt, Punctuation and Capitalization, Abbreviations and Numerals ,Proofreading, Using the Library

UNIT-III **9L**

Technical Writing

Report Writing: Meaning, Types, Structure, Methods and Models of Report Writing, Technical Proposal; Concept, Kinds, Layout, and Examples of Technical Proposal, Definitions, Characteristics, Structure, Letter Writing: Importance, Types, Layout, and examples of letters, Scientific and Technical Writing: Features, Methods, Examples, Project, Thesis and Dissertation Writing

UNIT-IV **9L**

Spoken and Presentation Skills

Impromptu speech – tackling hesitation, shyness and nervousness in speaking – Public speaking, academic and professional presentations – Group discussions – facilitators and

impediments Planning, preparing and delivering a presentation, essentials of presentation - etiquette; clarity; lively delivery – Speech generation; speech rhythm; speech initiators body language – voice, posture and gesture; eye contact; dress codes; verbal crutches; stresses, pronunciation – contextualization – creating and understanding contexts, Speech Drill.

Books & References

1. Complete Course in English - Dixon Robert J., Prentice Hall of India, New Delhi
2. A Practical English Grammar - Thomson and Martinet, ELBS
3. English Pronouncing Dictionary - Jones Daniel, Paperback
4. Spoken English - Bansal, R. K. & Harrison J. B., Orient Longman, India
5. Handbook of Pronunciation of English Words - Sethi J. & Jindal D.V.A, Prentice Hall of India,New Delhi
6. Word Power Made Easy - Lewis, Norman, Pocket Books
7. Business Correspondence and Report Writing - Sharma R.C. & Mohan Krishna, Tata McGrawHill
8. Business Communication - Chhabra T. N., Sun India Publication, New Delhi

BME-02 FUNDAMENTALS OF MECHANICAL ENGINEERING

Course category:	Engineering Fundamentals (EF)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The knowledge of basic laws of thermodynamics; steam generation and its properties; refrigeration cycles, properties, and machines; and reciprocating machines such as two/four strokes IC engines.
2. The knowledge of measurement instruments, types of transducers for measurement of different geometrical parameters and ferrous and non-ferrous engineering materials.
3. The ability to understand different types of stresses, Hooke‘s law and its applications, different mechanical properties of engineering materials and skill of their testing on different machines.
4. The knowledge of different types of supports on beams, shear force and bending moment

diagrams for statically determinate beams, stresses in simple bending of beams and torsion in circular shafts.

Topics Covered

UNIT-I **9L**

Thermodynamics

First and second law of thermodynamics, statements of Second Law of Thermodynamics and their equivalence, Third law of thermodynamics, Steam properties, Steam processes at constant pressure, volume, enthalpy and entropy, Classification of steam boilers, Efficiency and performance analysis, Refrigeration, Vapour compression and vapour absorption cycles, Coefficient of performance (COP), Refrigerant properties

Reciprocating Machines

Steam engines, hypothetical and actual indicator diagrams, Carnot cycle, Otto and Diesel cycles, Working of two and four strokes petrol and diesel IC engines.

UNIT-II **9L**

Measurement & Metrology

Introduction to measurement and measuring instruments, Types of sensors, Types of transducers and their characteristics, Measurement error and uncertainty analysis, Temperature, pressure, velocity, flow, strain, force and torque measurement, Measurement by dial gauges, slip gauges and sine bar

Engineering Materials

Classification, Ferrous and non- ferrous metals, Composition of cast iron and carbon steel,

mechanical properties, alloy steel and mechanical properties, Non-ferrous metals such as Cu, Al,Zn, Cr, Ni etc. and its applications.

UNIT-III **9L**

Simple Stress and Strain

Introduction, Normal and shear stresses, Poisson‘s ratio, Elastic constants and their relationships, Generalized Hooke‘s law, Deflection of bars of uniform and varying cross-sections, Strain energy in members due to static loading, Statically determinate problems, Stress-strain diagrams for ductile and brittle materials

Mechanical Properties and Testing

Toughness, Hardness, Fracture, Fatigue and Creep, Strength, and deformation testing, Bend/rebend testing, Hardness testing, Impact testing, Fatigue testing and creep testing, spring stiffness testing

UNIT-IV **9L**

Beams

Introduction, Types of supports, Beams classification, Free body diagram, Shear force and bending moment, Analysis of beams, Continuous loading and discontinuous loading, Shear force andbending moment diagrams for statically determinate beams

Pure Bending of beams

Introduction, Assumptions, Simple bending theory, Stress of beams of different cross sections

Torsion of Circular shafts

Introduction, Torsion of circular shafts, Shear stress due to torsion, Polar modulus, Power transmission

EXPERIMENTS

Note: Minimum Eight experiments are to be performed

1. Tensile strength test on universal testing machine
2. Compressive strength test on universal testing machine
3. Experiment on bend/rebend testing machine
4. Impact test on Impact testing machine
5. Hardness testing of given specimen on Vicker/Brinell hardness testing machine
6. Torsion test of a rod on torsion testing machine
7. Determination of closed coil and open coil spring stiffness on spring testing machine
8. Study of two stroke and four stroke engine
9. Study of slider crank mechanism
10. Experiment on fatigue testing machine
11. Experiments on bending of simple supported and cantilever beams
12. Study of steam boilers
13. Study of domestic refrigerator

Books & References

1. Basic and Applied Thermodynamics-P. K. Nag (Tata McGraw Hill)
2. Applied Thermodynamics-Onkar Singh (New Age International)
3. Elements of Materials science and Engineering-Van Vlash (Jhon Wiley & Sons)
4. Material Science-V. Raghvan (Prentice Hall India Limited)
5. Mechanical Measurement-G. Beckwith Thomas (Narosa Publishing House)
6. Mechanical Measurement – Sirohi (New Age Publications)
7. Strength of Materials-S. Ramamurtham (Dhanpat rai Publishing Co.)
8. Strength of Materials-R. K. Rajput (S. Chand)
9. Strength of Materials–R. K. Bansal (Lakshmi Publications)

BHM-04/ BAS-11 HUMAN VALUES & PROFESSIONAL ETHICS

Course category: Humanities & Social Science Electives (HSSE)

Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To create conducive environment for professionals to grow as good and responsible human beings imbibing values and ethics.
2. Understanding the significance of environment.
3. Developing humanitarian outlook.

Topics Covered

UNIT-I **6L**

Origin, Meaning, and Definition of Value, Types of Values, Individual Value, Family Value, Societal Value, Human Value, Value in Education System, Understanding Happiness andProsperity, Self-Exploration and Natural Acceptance.

UNIT-II **6L**

Harmony in family, Harmony in Society, Values Leading to Harmony, Creating a world family, Harmony in Nature, Environment and Sustainable Developmental, Legal aspects of Environment, Holistic Perspectives of Values, Existence and Co-existence.

UNIT-III **6L**

Origin, Meaning and Definition of Ethics, Ethics: The science of the Morality of The Art of Correct Living, Ethics in Human Acts, Ethics and Religion, Ethical Norms and Laws, Ethics inLiterature, Ethics in Science and Technology.

UNIT-IV **6L**

Ethical Approaches: - Theistic Approach, Atheistic Approach, General and Special Ethics, Professional Ethics: Ethics at workplace, Ethics as Skill, Values and Ethics, Ethics with Value Education, Managerial and Business & Corporate Ethics, Corporate Social Responsibilities.

Books & References

1. Bangaria, G. P et.al, a foundation course in Human Values and Professional Ethics**,** Excel books.
2. Govindrajan, M Professional Ethics and Human Values, Eastern Economy Edition
3. Naagrazan, R.S. Textbook on Professional Ethics and Human Values**,** New age International.
4. Misra, Anuranjan and Shukla**,** Dr. R.K. Human values and Professional Ethics, Amazon (PaperBack).

Fernando, A.C Business Ethics**:** An Indian Perspective, Pearson, India.

BCE-10 ENGINEERING GRAPHICS

Course category:	Engineering Fundamentals (EF)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 4
Number of Credits:	2
Course Assessment methods:	Continuous assessment through viva-voice, Practical work/record, attendance, and Major Practical Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. How Engineering Drawing helps to sketch the imagination?
2. Able to effectively practice the different scale for drawings.
3. Effectively analyze the geometrical shapes and to be able to draw.
4. Know about out solids and discuss about their classification.
5. How to implement the different views for a solid placed in 3D space.
6. Construction of the object from different perspective.
7. Comparison and contrast between frustum and truncated solid.
8. Sketching of different sections for any 3D regular object.
9. Discussing the principles of Isometric Projection.
10. Sketching isometric projections for different geometrical shapes and solids.

Topics Covered

UNIT-I

Title: Conic Sections and Orthographic Projections Introduction

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

Orthographic Projections covering Principles of Orthographic Projections- Conventions Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Plane

UNIT-II

Title: Projection of Regular Solids

Projections of Regular Solids covering those inclined to both the Planes- Auxiliary Views

UNIT-III

Title: Sections and Sectional Views of Right Angular Solids

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

UNIT-IV

Isometric Projections

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, demonstrating knowledge of the theory of CAD software.

Books & References

1. Engineering Drawing-Bhat, N.D.& M. Panchal, Charotar Publishing House, 2008
2. Engineering Drawing and Computer Graphics- Shah, M.B. & B.C. Rana, Pearson Education, 2008
3. A Textbook of Engineering Drawing-Dhawan, R.K., S. Chand Publications,2007
4. Textbook on Engineering Drawing-Narayana, K.L. & P Kannaiah, Scitech Publishers, 2008

BMS-04/BAS-21 ENGINEERING MATHEMATICS-III

Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of Residue theorem and Integral formula to evaluate various integrals.
2. Use of moments and kurtosis to find the type of curve.
3. To interpolate a curve using Gauss, Newton's interpolation formula.
4. To find the derivative of a curve and area of a curve.

Topics Covered

UNIT-I **9L**

Functions of Complex Variable: Analytic function, C-R equations, Cauchy-Integral Theorem, Cauchy-Integral formula, Taylor's Series and Laurent Series, Zero's and Singularities, Residue theorem, Evaluation of the real integrals of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ *and* $\int_{-\infty}^{+\infty} f(x)dx$.

UNIT-II **9L**

Statistical Techniques: Moments, Generating function for moments, Skewness, Kurtosis, and Curve fitting: Method of Least Squares, Fitting of Straight lines and Parabola. Correlation and Regression. Binomial Distribution, Poisson's Distribution, and Normal Distributions.

UNIT-III **9L**

Numerical Techniques: Solution of polynomial equations by Bisection, Regula-Falsi and Newton-Raphson's methods. Interpolation: Newton's forward and backward interpolation formulae, Lagrange's and Newton's divided difference methods for unequal intervals.

UNIT-IV **9L**

Solution of Linear and Differential equations and Numerical Integration: Solution of linear equations by Crout's method and Guass-Siedel method. Solution of ordinary Differential equations by Euler's, Picard's and Fourth order Runge-Kutta methods. Numerical Integration by Trapezoidal, Simpson's one-third and Simpson's three-eight rules.

Books & References

1. B.S. Grewal - Higher Engineering Mathematics; Khanna Publishers.
2. B.V. Ramana - Higher Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. H.K. Dass and Rama Verma - Engineering Mathematics; S. Chand Publications
4. N.P. Bali and Manish Goel - Engineering Mathematics; Laxmi Publications.

BME-15 ENGINEERING MATERIALS

Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2

Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The importance of numerous materials with their basic concepts including crystallography and imperfections.
2. The understanding about the advanced materials testing by different mechanical testing methods such as strength testing, hardness, fatigue, NDT, etc.
3. Different surface behavior studies of engineering materials including heat treatmentprocesses, TTT diagram and other related processes.
4. Different concepts regarding materials and electrical, magnetic, electronic, etc.properties.

Topics Covered

UNIT-I **9L**

Introduction

Importance of materials, Brief review of modern & atomic concepts in Physics and Chemistry.Atomic models

Crystalline nature of solids

Crystal system unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices, Imperfections, Defects & Dislocations in solids.

UNIT-II **9L**

Mechanical properties and Testing

Stress strain diagram for Ductile & brittle material, Toughness, Hardness, Fracture, Fatigue and Creep. Testing of materials such as Strength tests, Hardness tests, Impact tests, Fatigue tests, Creeptests, Cold and Hot working of metals and their effect on mechanical properties.

Phase Diagram and Equilibrium Diagram

Unitary and Binary diagrams, Phase rules. Types of equilibrium diagrams: Solid solution type, eutectic type and combination type, Iron-carbon equilibrium diagram.

UNIT-III **9L**

Ferrous & Non-ferrous material

Various types of carbon steels, alloy steels and cast irons, its properties, uses and applications, Heat Treatment: Various types of heat treatment processes such as Annealing, Normalizing, Quenching, Tempering, and various case hardening processes. Time Temperature Transformation (TTT) diagrams. Diffusion: Diffusion of Solids, Fick‘s I and II

law.

Non-Ferrous metals and alloys

Non-ferrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications.

UNIT-IV **9L**

Dielectric & Magnetic properties

Dielectric Materials and their applications, Concept of magnetism- Dia, para, ferro magnetic materials, Hysteresis, Soft and hard magnetic materials, Magnetic Storages

Electronic Properties

Energy band, concept of conductor, insulator, and semiconductor. Intrinsic and extrinsic semi-conductors, P-n junction and transistors, Basic devices, and their applications. Bragg's law, Messier effect. Type I & II superconductors. High Temp. superconductors. Brief description of other material such as optical and thermal materials, Composite Materials and its uses, Smart materials
& Nanomaterials and their potential applications.

EXPERIMENTS

Minimum Eight experiments are to be conducted from the following:

1. Tensile test on universal testing machine
2. Compressive on universal testing machine
3. Torsion test of a rod on torsion testing machine
4. Creep test on creep testing machine
5. Fatigue test on fatigue testing machine
6. Hardness testing of given specimen on Vicker/Brinell/Rockwell hardness testing machine
7. Determination of deflection of cantilever under point/uniformly distributed loading
8. Determination of deflection of beam under point/uniformly distributed loading
9. Study of corrosion and its effects.
10. Comparative study of microstructures of different specimens of different materials (mild steel, gray C.I., brass, copper etc.)
11. Study of heat treatment processes such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after heat treatment.
12. Study of non destructive testing methods such as ultrasonic flaw detector, magnetic flaw detector and eddy current testing machine.

Books & References

1. Material Science and Engineering – Smith, Hashemi and Prakash (Tata McGraw Hill)
2. Material Science- Narula (Tata McGraw Hill)
3. Material Science for Engineering Students- Fischer (Academic Press)

4. Material Science & Engineering - Van Vlash (John Wiley & Sons)
5. Elements of Material Science & Engineering -W.D. Callister (Wiley India Pvt. Ltd.)
6. Technology of Engineering Materials- Philip and Bolton (Butterworth-Heinamann)
7. Material Science -V. Raghvan (Prentice Hall of India)
8. Elements of Material Science & Engineering- Van Vlack (Pearson)

BEC-12 DIGITAL ELECTRONICS AND CIRCUITS

Course category:	Engineering Fundamentals (EF)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Acquired knowledge about basics of digital electronics and solving problems related to number systems and Boolean algebra.
2. Ability to identify, analyze and design combinational and sequential circuits.
3. To design, implement and evaluate various synchronous and asynchronous sequential circuits and applications.
4. Acquired knowledge about internal circuitry and logic behind any digital system.

Topics Covered

UNIT-I **9L**

Digital system and Binary numbers: Signed binary numbers, Floating point number, Binary Codes, Cyclic codes, Error detecting and correcting codes, Hamming codes. NAND and NOR implementation, Minimization of circuit using K-map and Tabular method up to five variables, POS and SOP simplification, Logic family- TTL, DTL, ECL, CMOS, HMOS

UNIT-II **9L**

Combinational Logic: Analysis and Design procedure for Combinational circuits, Binary adder/subtractor, Binary multiplier, Booth Algorithm, Magnitude comparator, Encoder/ Multiplexer, adder/subtractor, Binary multiplier, Booth Algorithm, Magnitude comparator, Encoder/ Multiplexer, Decoder/Demultiplexer.

UNIT-III **9L**

Sequential Logic: Sequential circuits, Latches, Flip-flops, Conversion of flip-flops, Analysis of clocked sequential circuits, State reduction and assignments.

Registers and Counters: Shift registers, Asynchronous counter, Synchronous Counter, Sequential circuit Analysis and design procedure, Circuit with latches, Hazards.

UNIT-IV **9L**

Memory and Programmable Logic: Read only Memory, Read/Write Memory-SRAM and DRAM. Programmable Logic Devices, -PLAs, PALs and their applications; Sequential PLDs and their applications; State machine design with sequential PLDs: Introduction, to field programmable gate arrays (FPGAs).

EXPERIMENTS

A. Compulsory Experiments

1. Design and verification of following arithmetic circuits using 74xx family ICs.
    a. Half adder and Full adder
    b. Half subtractor and full subtractor
2. To perform the code conversion- binary to gray and gray to binary and its truth table verification.
3. To design a combinational logic circuit using 74xx family ICs and its truth table verification in both SOP and POS forms.
4. Realization of 2:4 decoders and 4:2 encoder circuit and verification of its truth table.
5. To design and verify the truth table of multiplexer and demultiplexer circuits.
6. To design a 1-bit comparator using 74xx family ICs and to study the performance of4-bit comparator IC7485.
7. Design and verification of basic Flip-Flops using 74xx family ICs and master-slave JK flip-flop using IC7476.

B. Optional Experiments

1. To realize and verify the truth table of shift register-SIPO/SISO and PISO/PIPO.
2. Design and verification of asynchronous counter design and Mod-n counter.
3. To realize and verify the truth table of synchronous counter design.
4. To conduct an experiment to store a set of data in a RAM using IC 7489 starting from location---------to location and retrieve the same data.
5. To study and verify the functional table of 4-bit ALU using IC74181.

Books & References

1. Hill & Peterson, “Switching Circuit & Logic Design”,Wiley.
2. Digital principle and applications Malvino and Leach-(TMH)

BEE-11 BASIC SYSTEM ANALYSIS

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Analyse as well as synthesize Continuous and discrete signals.
2. Classify and identify different signals
3. Familiarity with continuous and discrete models and their representation.
4. Acquire the knowledge of analogous electrical systems of different non- electrical systems.
5. Application of Laplace, Z and Fourier Transform.
6. Modelling through State variable analysis

Topics Covered

UNIT-I **9L**

Introduction to continuous time signals and systems:
Basic continuous time signals, unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics. Introduction to various types of systems.

Analogous System:
Linear mechanical elements, force-voltage, and force-current analogy, modeling of mechanical and electro-mechanical systems: Analysis of first and second order linear systems by classical method

UNIT-II **9L**

Fourier Transform Analysis:
Exponential form and Trigonometric form of Fourier series, Fourier symmetry, Fourier Integral and Fourier Transform. Transform of common functions and periodic wave forms: Applications of Fourier Transform to network analysis.

Laplace Transform Analysis:
Review of Laplace Transform, Laplace Transform of periodic functions, Initial and Final Value Theorems, Inverse Laplace Transform, Convolution Theorem, Superposition Integral, Application of Laplace Transform to analysis of networks, waveform synthesis and Laplace Transform of complex waveforms**.**

UNIT-III **9L**

State Variable Analysis:

Introduction, State Space representation of linear systems, Transfer Function and state Variables, State Transition Matrix, Solution of state equations for homogeneous and non-homogeneous systems, Applications of State-Variable technique to the analysis of linear systems.

UNIT-IV **9L**

Z-Transform Analysis:
Concept of Z-Transform, Z-Transform of common functions, Inverse Z-Transform, Initial and Final Value theorems, Applications to solution of difference equations, Pulse Transfer Function

Books & References

1. David K. Cheng; "Analysis of Linear System", Narosa Publishing Co.
2. ME Van-Valkenberg; "Network Analysis", Prentice Hall of India
3. L.Wadhwa, "Network Analysis and Synthesis", New Age International Publishers,2 007.
4. Samarajit Ghosh, "Network Theory: Analysis and Synthesis" Prentice Hall of India, 2008
5. Choudhary D. Roy, "Network & Systems", Wiley Eastern Ltd.
6. Donald E. Scott, "Introduction to circuit Analysis" Mc. Graw Hill
7. B.P. Lathi, "Linear Systems & Signals" Oxford University Press, 2008.
8. J. Nagrath, S.N. Saran, R. Ranjan and S. Kumar, "Signals and Systems, "Tata Mc. Graw Hill, 2001.
9. Taan S. Elali & Mohd. A. Karim, "Continuous Signals and Systems with MATLAB" 2nd Edition, CRC Press.

BEE-12 ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basic concept of measurement, instrumentation, working & performances of different kind of measuring instruments
2. Ability to analyze performance characteristics of measuring instruments.
3. Ability to know, working principle & Performances of AC Bridges.
4. Ability to understand construction, principle of operation, working and applications of waveform analyzers and spectrum analyzers.
5. Ability to understand construction, principle of operation, working and applications of harmonic distortion analyzers.

6. Ability to understand construction, principle of operation, working and measurements of Cathode Ray Oscilloscope (CRO).

Topics Covered

UNIT-I **9L**

Fundamentals of Measurement Systems
Philosophy of measurement, methods of measurements, classification of measurement system, functional elements of measurement, units, dimensions & standards, static performance characteristics, errors analysis, loading effect of instrument, uncertainty in compound quantity, histogram, deviation, dispersion, standard deviations, variance, Gaussian's distribution curve analysis

UNIT-II **9L**

Analog Measurement of Electrical Quantities
Types of measuring instruments, secondary instruments, essentials components of instruments, design of sprigs, pivot & jewels, Ammeters & Voltmeters; moving coil, moving iron, electrodynamic, electrostatic, rectifier & thermocouple type, Measurement of power, wattmeter, Measurement of energy, induction type energy meter, errors & remedies in wattmeter and energy meter, frequency meters.

UNIT-III **9L**

Instrument Transformers & A.C. Bridges
Instrument Transformer (CT &PT) and their applications in the extension of instrument range, Different methods of measuring low, medium, and high resistances**,** measurement of inductance & capacitance with the help of AC Bridges.

UNIT-IV **9L**

Magnetic Measurement & Digital Measurement of Electrical Quantities

Flux meter**,** determination of hysteresis loop, measurement of iron losses**.** Concept of digital measurement, block diagram study of digital voltmeters (DVM), Spectrum analyzers, Wave Analyzer and Harmonics distortion analyzer; Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its components**,** application of CRO in measurement, Lissajous Pattern.

EXPERIMENTS

1. Calibration of ac voltmeter and ac ammeter.
2. Calibration of single of induction type energy meter with the help of wattmeter.
3. Extension of range instruments using CT & PT.
4. Determination of iron loss using Lloyd Fisher's square method.
5. Measurement of phase difference and frequency of a sinusoidal ac voltage using C.R.O.

6. Measurement of power and power factor of a load using three voltmeter method.
7. Measurement of low resistance by Kelvin's double bridge.
8. Study of Maxwell's inductance bridge.
9. Study of Schering bridge.
10. Study of Hay's bridge.
11. Study of Anderson's bridge.
12. Study of Owen's bridge.

Books & References

1. E. W. Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", A. W. Wheeler & Co. Pvt. Ltd. India.
2. A. K. Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai& Sons India.
3. E. O. Deblin, "Measurement System – Application & design", McGraw Hill.
4. Forest K. Harries, "Electrical Measurement", Willey Eastern Pvt. Ltd. India.
5. M.B. Stout, "Basic Electrical Measurement" Prentice Hall of India, India.
6. W. D. Cooper," Electronic Instrument & Measurement Technique "Prentice Hall International.
7. B.C. Nakra & K. Chaudhry, "Instrumentation, Measurement and Analysis", Tata McGraw Hill 2nd Edition.
8. J. B. Gupta, "Electrical Measurements and Measuring Instruments", S.K. Kataria & Sons

BEE-20A SIMULATION TECHNIQUES

Course category:	Engineering Fundamentals (EF)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 6
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To gain knowledge on MATLAB software and its basic functions.
2. To acquire the knowledge & application of numerical technique in MATLAB functions.
3. To develop the MATLAB programming skill.

4. With the above knowledge/skill, students will be able to solve simultaneous linear equations, differential equations etc., applied in the electrical circuit solutions.
5. To develop and verify the concepts of various complex electrical engineering problems using MATLAB software.

EXPERIMENTS

1. Solution of linear equations for under damped and over damped cases.
2. To study the usefulness of MATLAB toolboxes.
3. To study the usefulness of Simulink Models.
4. To study the Optimization based toolboxes.
5. Determination of Eigen values and eigenvectors of a square matrix.
6. Determination of roots of a polynomial.
7. Determination of polynomial using method of least square curve fitting.
8. Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.
9. Solution of differential equations using 4th order Runge-Kutta method.
10. Solution of differential equation using revised Euler method.
11. Solution of difference equations.
12. Determination of time response of an R-L-C circuit.
13. Demonstration of feedback system using Simulink Models.
14. Design the simulink model for DC motor.
15. Design the simulink model of electrical circuits wattmeter method.
16. To perform O.C. and S.C. test of a single-phase transformer.
17. To draw the magnetization characteristics of separately excited dc motor.
18. To perform the external load characteristics of dc shunt motor.

Books & References

1. Amos Gilat, "MATLAB: An Introduction with Applications" Wiley India Ltd., 2004.
2. R. P. Singh, "Getting Started with MATLAB" Oxford University Press, 2002.

BMS-08/BAS-23 ENGINEERING MATHEMATICS-IV

Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of Laplace Transform to solve the differential equation.
2. Use of Fourier transforms, and Z transforms to solve the differential equation.
3. To solve the partial differential equations using Lagrange and charpits method.
4. Application of partial differential equation in real life problems.

Topics Covered

UNIT-I **9L**

Integral Transform I: Laplace Transform Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function. Laplace transform of periodic function, Impulse function.
Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

UNIT-II **9L**

Integral Transform II: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one-dimensional heat transfer equation, wave equation.
Z- transform and its application to solve difference equations.

UNIT-III **9L**

Partial Differential Equations
Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

UNIT-IV **9L**

Applications of Partial Differential Equations: Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two dimensions, Heat conduction equations up to two dimensions.

Books & References

1. B.S. Grewal - Higher Engineering Mathematics; Khanna Publishers.
2. B.V. Ramana - Higher Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. H.K. Dass and Rama Verma - Engineering Mathematics; S. Chand Publications.
4. N.P. Bali and Manish Goel - Engineering Mathematics; Laxmi Publications.

MBA-01 INDUSTRIAL MANAGEMENT

Course category: Management (M)
Pre-requisite Subject: NIL

Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Student will become efficient and acquire acumen of more profitable business practices.
2. Students will understand importance of better customer service and product quality.
3. Able to make work safer, faster, easier, and more rewarding.
4. Able to help industry in production of more products which possess all utility factors.
5. Making the world safer through better designed products and processes.
6. Reducing costs associated with new technologies.

Topics Covered

UNIT-I **6L**

Introduction: Management and Industrial Engineering and relation with other fields, Management concepts.

Plant Location and Layout: General considerations, Types of Layout, Cellular Manufacturing.

UNIT-II **6L**

Work Analysis and Measurement: Design of work methods, Time and motion study, Work sampling, Selection of labour and wage payment, Incentive, and motivation.

Functional Management: Sources of finance, Balance sheet and Income statement, Different element of costs, Depreciation, Break-even analysis, Economic appraisal of projects.

UNIT-III **6L**

Production Planning and Control: Methodology, Aggregate Planning, Scheduling, Line of Balancing.

Quality Control: Concepts of quality, Acceptance sampling, Control Charts, Total Quality Management.

UNIT-IV **6L**

Material Management: Inventory management, Deterministic and probabilistic models of Inventory control, Material requirements Planning JIT, ERP, SCM Business Process reengineering.

Project Management: CPM and PERT, Cost consideration and Crashing

Books & References

1. Joel Dean.. Managerial Economics, PHI Ltd., New Delhi.
2. P. Crowson.. Economics for Managers, Macmillan, London.
3. Prasanna Chandra.. Financial Management, TMH Pvt. Ltd., New Delhi.

BEE-13 ELECTRO-MECHANICAL ENERGY CONVERSION –I

Course category:	Department Core (DC)
Pre-requisite Subject:	Electrical Circuits and Analysis
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Ability to learn basic concept of design, working & performances of DC Machine (Generator & Motor).
2. Ability to solve theoretical & numerical problems related with DC Machines (Generator & Motor).
3. Ability to know constructional details, working principle & Performances of Single Phase & 3 phase transformer.
4. Ability to understand electro-mechanical energy conversion process of rotating electrical machines in singly exited & doubly excited magnetic system

Topics Covered

UNIT-I **9L**

Principles of Electro-mechanical Energy Conversion –
Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems, singly Excited Systems; Doubly excited Systems; derivation of mechanical force, mechanical energy and torque in magnetic field system, generated EMF in electrical machines

UNIT-II **9L**

D.C. Machines-I-

Construction of DC Machines, parts of dc machine, armature winding, types of dc generators, Emf and torque equation, Armature Reaction, Commutation process, Inter pole and Compensating Windings, Performance Characteristics of D.C. generators under no load and loaded conditions.

UNIT-III **9L**

D.C. Machine-II

DC motors, operating characteristics of D.C. motors, back EMF and torque equation, necessity of starters, types of starters, Speed control of D.C. motors, Field Control, armature control and voltage control, losses, Efficiency, and various Testing on D.C motors.

UNIT-IV **9L**

Transformer:

Construction& working of single-phase transformer, types of transformers, equivalent circuit models, efficiency, voltage regulation, various testing methods, Single phase auto transformers, efficiency, merits & demerits, and applications of auto transformer. Construction & various connection diagrams of three phase transformers, phasor groups, parallel operation of three phase transformers, harmonics in transformers, three winding transformers.

EXPERIMENTS

1. To obtain magnetization characteristics of a d.c. shunt generator
2. To obtain load characteristics of a d.c. shunt generator.
3. To obtain efficiency of a dc shunt machine using Swinburn's test.
3. To perform Hopkinson's test and determine losses and efficiency of DC machine
4. To obtain speed-torque characteristics of a dc shunt motor and series motor.
5. To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control
6. To obtain speed control of dc separately excited motor using Ward-Leonard.
7. To study polarity and ratio test of single phase and 3-phase transformers
8. To obtain equivalent circuit, efficiency and voltage regulation of a single transformer using open circuit and short Circuit test.
9. To obtain efficiency and voltage regulation of a single-phase transformer by Sumpner's test.
10. Study of 3-phase to 2-phase conversion by Scott connection.

Books & References

1. I.J. Nagrath & D. P. Kothari," Electrical Machines", Tata McGraw Hill
2. Ashfaq Husain," Electrical Machines", Dhanpat Rai& Sons
3. U.A Bakshi and M. V. Bakshi, "Electromechanical Energy Conversion-I", Technical Publication Pune.

4. B.R. Gupta & Vandana Singhal, "Fundamentals of Electrical Machines, New International.
5. Irving L. Kosow, "Electric Machine and Transformers", Prentice Hall of India.
6. M. G. Say, "The Performance and Design of AC machines", Pit man & Sons.
7. P. S. Bimbhra, "Electrical Machinery", Khanna Publisher

BEE-14A NETWORK ANALYSIS AND SYNTHESIS

Course category:	Department Core (DC)
Pre-requisite Subject:	Electrical Circuits and Analysis
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to solve the circuits through graph theory.
2. Able to understand the concept of transfer function & time response analysis.
3. Able to analyze a two-port network.
4. Able to synthesis a network.
5. Able to understand the basic concepts of filter.

Topics Covered

UNIT-I **9L**

Network Theorems
Fundamentals to Network Analysis, Thevenin's and Norton's theorem, Superposition theorem, Maximum Power Transfer theorem, Millman's theorem, Tellegen's theorem, Compensation theorem and Reciprocity theorem. Problems with ac and dependent sources.

UNIT-II **9L**

Two Port Networks:
Characterization of LTI two port networks Z, Y, ABCD and h parameters, reciprocity, and symmetry. Inter-relationships between the parameters, Inter-connections of two port networks, Ladder and Lattice networks, T & Π Representation.

UNIT-III **9L**

Introduction to Graph Theory:
Graph of a Network, definitions, tree, co tree, link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop, and Nodal methods of analysis.

Network Functions:
Concept of Complex frequency, Transform Impedances Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot

UNIT-IV **9L**

Network Synthesis:
Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.
Introduction to Filters.

EXPERIMENTS

1. Verification of Superposition Theorem.
2. Verification of Thevenin's Theorem.
3. Verification of Norton's theorem.
4. Verification of Maximum power transfer theorem.
5. Verification of Reciprocity Theorem.
6. Star Delta Transformation
7. Power Factor Improvement
8. To plot frequency response of a series resonant circuit.
9. To plot frequency response of a parallel resonant circuit.
10. To measure input impedance and output impedance of a given two port networks.
11. To design a Π attenuator which attenuate given signal to the desired level.

Books & References

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. A. Chakrabarti, "Circuit Theory" Dhanpat Rai & Co.
3. C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers, 2007.
4. D. Roy Choudhary, "Networks and Systems" Wiley Eastern Ltd.
5. Donald E. Scott: "An Introduction to Circuit analysis: A System Approach" McGraw Hill
6. M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
7. N. C. Jagan and C. Lakshminarayana, "Network Analysis" B.S. Publications, 2008.
8. K. S. Suresh Kumar, "Electric Circuits and Networks" Pearson Education, 2009.
9. A. Ramakalyan, "Linear Circuits: Analysis and Synthesis" Oxford University Press, 2005.

BEE-15A MICROPROCESSOR: ARCHITECTURE, PROGRAMMING, AND INTERFACING

Course category:	Department Core (DC)
Pre-requisite Subject:	Electrical Circuits and Analysis
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Learning objective:

This subject helps student to learn the

- Microcomputer systems and its associated hardware
- Detailed architecture of the Intel 8085microprocessor.
- Operation and control, instruction set and interrupts of the microprocessor
- Assembly language programming with the 8085 microprocessors
- Intel 8255 and 8254 peripheral interfaces
- Architecture and operation of the intel 8086 microprocessor.

Course outcome:

The students should be able to use and apply

- The hardware knowledge of 8085 microprocessor
- The programming skill on 8085 microprocessor-based applications along with peripheral interfaces
- The knowledge on intel 8086 microprocessor architecture and operation.

Topics Covered

UNIT-I **9L**

Introduction to Microcomputer Systems and Hardware: History of computers computer Language, Large computers to single chip Microcomputers. Evolution of Microprocessors Microprocessor Architecture and its operations, memory, Input/output. Interfacing Devices 8085 Microprocessor: pin configuration. Internal architecture, control and status signals interrupts, bus timings.de-multiplexing of address bus generating control signals, ALU, Flag, register.

UNIT-II **9L**

Operation and control of Microprocessor: Decoding and executing an instruction. Op-code fetch machine cycle memory read/write machine cycles. I/O read/write machine cycles interrupt acknowledge machine cycle, state-transition diagram.

Instruction Set: Addressing modes: Data transfer, arithmetic, logical, branch, stack and machine control groups of instruction set, macro RTI and micro-RTL flow chart of few typical instructions unspecified flags and instructions unspecified flags and instructions.

Interrupts: Interrupt structure of 8085 microprocessor processing of vectored and nin-vectored interrupts. Latency time and response time handling multiple interrupts.

UNIT-III **9L**

Assembly Language Programming for 8085 microprocessor Assembler examples: Subroutines. Parameter passing to subroutines. Programming techniques with looping counting and indexing counter and timing delays.

Serial and Parallel Input and output: memory mapped I/O I/O mapped I/O, programmed I/O interrupt Driven I/O DMA I/O.

Programmable Peripheral Interface: Intel 8285 pin configuration, internal structure of a port bit. Modes of operation. Bit SET/RESET feature.

Programmable Interval Timer: Intel 8253 pin configuration, internal block diagram of counter and modes of operation, counter read methods.

UNIT-IV **9L**

16-bit Microprocessor: Architecture of Intel 8086 (Bus Interface Unit, Execution Unit), register organization, memory addressing, memory segmentation, operating modes, addressing modes, instruction set, hardware and software interrupts, responses, and types.

EXPERIMENTS

Course Learning Objective

This subject helps student to learn the

- To become familiar with 8085 microprocessor training kit.
- To be able to write Intel 8085 microprocessor-based assembly language program.
- To become familiar with 8085 microprocessor software simulators

Course outcomes

The students should be able to use and apply

- The Intel 8085 based microcomputer training kits/software simulator.
- The knowledge of the 8085 microprocessors to write typical assembly language programs
- The programming to the peripheral devices interfaced with the Intel 8085 based microcomputer.

Perform at least any ten experiments from the following:

1. To become familiar with 8085 microprocessor training kit/Software Simulator and execute following programs.
   - Add two 8-bit numbers stored in register B & C store result in register D.
   - Subtract 8-bit data stored at memory location 4021h from data stored at memory location 4020h. Store result at memory location 4022h.
   - To perform OR operation between accumulator and register B. Store result in register C.
2. To become familiar with 8085 microprocessor simulator and simulate following programs using simulator
   - Write a program to interchange content of register B and C
   - Subtract content of register E from register B.
   - Complement content of accumulator and display result on output port PORT2.
   - Perform logical OR operation between register B and C, logical AND operation between accumulator and register B.
3. Write a program to transfer set of data from memory location 2050-205Fh to 2060-206Fh
4. Write a program to find smallest number from given set of data stored at location 2040h to 205Fh
5. Write a program to find negative numbers in given set of data stored at the location 2050h to 205Fh
6. Write program to arrange an array of data in ascending order
7. Write a program to multiply two 8-bit numbers stored at the location 2100 and 2101. Store result at memory location 2102h
8. Write program to divide 16-bit number stored at memory location 2100h and 2101h by 8 bit number stored at memory location 2102h. Store the quotient in memory locations 2110h and 2111h, remainder at memory location 2112h.
9. Write a program to convert hexadecimal number into equivalent BCD number
10. Write a program to check parity of data stored at memory location 2100. Move content EEh to register B, if parity is even and 00h if parity is Odd.
11. To interface Programmable peripheral interface (PPI) IC-8255 with 8085 Microprocessor in Mode 0.
12. To generate square wave on port pin PC7 of 8255 in BSR mode.

Books & References

1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.
2. Uffenbeck, John, "Microcomputers and Microprocessors" PHI/ 3rd Edition.
3. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programaming and Interfacing" Tata Mc. Graw Hill.
4. Krishna Kant, "Microprocessors and Microcontrollers" PHI Learning.
5. Brey, Barry B. "INTEL Microprocessors" Prentice Hall (India)
6. Aditya P. Mathur, "Introduction to Microprocessor" Tata McGraw Hill
7. M. Rafiquzzaman, "Microprocessors- Theory and applications" PHI

8. B. Ram, "Advanced Microprocessor & Interfacing" Tata McGraw Hill
9. Renu Singh & B.P.Singh, "Microprocessor and Interfacing and applications" New Age International
10. Hall D.V., "Microprocessors Interfacing" Tata McGraw Hill
11. Liu and Gibson G.A., "Microcomputer Systems: The 8086/8088 Family" Prentice Hall

BHM-03/BAS-20 COMMUNICATION SKILLS

Course category:	Engineering Fundamentals (EF)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 4
Number of Credits:	4
Course Assessment methods:	Continuous assessment through one viva voice, Practical work/record, attendance, and Major Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Overcome the problems he/she faces in oral and written communication.
2. Acquire knowledge of and methods for using technical communication such as reports, proposals, and business letters, etc.
3. Use and practice compositions correctly.
4. Give Presentations in different sessions and make self-appraisal.

Topics Covered

UNIT-I

Software to be used: Learn to Speak English and Present individually and in group Introduction to vowel and consonant sounds; introduction to syllable stress; noun stress; voiced and voiceless sounds; diphthongs; rate of speech.

UNIT-II

Fluency Building – word match, reading aloud, recognition of attributes, parts of speech in Listening, reading and writing.

UNIT-III

Group Discussion, Argumentative Skills, Interview skills, completing the steps involved in Career, Life Planning and Change Management.

UNIT-IV

Presentation skills, Extempore (on-spot speech delivery), Improving body language and cross-cultural communication with pictures, making an oral presentation in English.

Books & References

1. A Manual for English Language Laboratory, Sudha Rani, Pearson.
2. English Language Communication Skill (lab).
3. Malcome Goodale, ―Professional Presentations‖, (VCD) New Delhi: Cambridge University Press, 2005.
4. Robert M. Sherfield and et. al ―Developing Soft Skills‖,4th Edition, New Delhi, Pearson Education, 2009.
5. Study Materials from CIEFL, Hyderabad.

MBA-02 ENGINEERING AND MANAGERIAL ECONOMICS

Course category:	Management (M)
Pre-requisite Subject:	General Management
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, assignments, quizzes, One Minor test, and Major Theory Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Engineering & managerial economics, which allows students to gain theoretical and empirical skill of economics.
2. To make Engineering students prepared for economic empowerment so that they could manage their wealth, help them in starting their own business or during managerial period.
3. Students will develop Interdisciplinary skills which can help them to thrive in the lifelong changing environment in various fields of Industry of Economics.
4. Students will acquire practical knowledge of economics, the kind of markets, cost theory, various issues of demand and other major economic concepts.
5. Able to explain succinctly the meaning and definition of managerial economics; elucidate on the characteristics and scope of managerial economics.
6. Able to describe the techniques of managerial economics.
7. Able to explain the applications of managerial economics in various aspects.
8. To learn about the management and economics of the industrial environment

Topics Covered

UNIT-I **6L**

Introduction: Meaning, Nature and Scope of Economics, Meaning of Science, Engineering and Technology. Managerial Economics and its scope in engineering perspective

Basic Concepts: Demand Analysis, Law of Demand, Determinates of Demand, Elasticity of Demand Price, Income, and cross Elasticity. Uses of concept of elasticity of demand in managerial decision.

UNIT-II **6L**

Demand Forecasting: Meaning, significance and methods of demand forecasting, production function, Laws of returns to scale & Law of Diminishing returns scale. An overview of short and long run cost curves – fixed cost, variable cost, average cost, marginal cost, Opportunity cost.

UNIT-III **6L**

Market Structure: Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

National Income, Inflation and Business Cycles: Concept of N.I. and Measurement. Meaning of Inflation, Type causes & prevention methods, Phases of business cycle

UNIT-IV **6L**

Concept of Goals, Resources, Efficiency & Effectiveness; Introduction to Management discipline and activity, Managerial Roles and Skills; Management Thought and Thinkers-Details: Scientific Management; Classical

Organization Theory; Neo-Classical Theory; Systems Approach; Contingency Approach. Managerial Functions and Decision Making

Books & References

1. Koutsoyiannis A: Modern Microeconomics, ELBS.
2. Managerial Economics for Engineering: Prof. D.N. Kakkar
3. Managerial Economics: D.N. Dwivedi
4. Managerial Economics: Maheshwari.
5. Principles & Practices of Management: L.M. Prasad
6. Industrial Economics and Principles of Management: T.N. Chabra

BEE-26 ELECTRO-MECHANICAL ENERGY CONVERSION – II

Course category:	Department Core (DC)
Pre-requisite Subject:	Electromechanical Energy Conversion-I
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva

voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Ability to learn basic concept of design, working & performances of three phase AC Machines (Generator & Motor).
2. Ability to solve theoretical & numerical problems related with three phase AC Machines (Generator & Motor).
3. Ability to know constructional details, working principle & Performances of Single-Phase AC Machines.
4. Ability to understand working, characteristics & applications of Special Electrical Machines (Universal Motor, AC series motor, Hysteresis Motor, Reluctance Motor)

Topics Covered

UNIT-I **9L**

Synchronous Machine I:
Constructional features, types and working of AC generator, EMF Equation, Armature reaction, O. C. & S. C. tests, Voltage Regulation, and calculations of voltage regulation by different methods, Parallel Operation of synchronous generators, synchronization of ac generators, synchronizing power, concept of X_d, and X_q.

UNIT-II **9L**

Synchronous Machine II:
Two Reaction Theory, Power flow equations of cylindrical and salient pole machines, operating Characteristics, Synchronous Motor**,** power flow and torque equation, Effect of varying field current at different loads, V- Curves, Hunting, damper windings, synchronous condenser, and application of synchronous motor.

UNIT-III **9L**

Three phase Induction Machine:
Constructional features, rotating magnetic field, working principle, Phasor diagrams, equivalent circuits, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, losses, efficiency, starting methods, various speed control techniques, Deep bar and double cage type rotors, Cogging & Crawling effects, Induction generator, applications.

UNIT-IV **9L**

Single phase Induction Motor:
Double revolving field theory, Equivalent circuits, no load and blocked rotor tests, Starting methods, types of single-phase induction motors, Repulsion motor, Universal motor, A.C. series motor, hysteresis motor.

EXPERIMENTS

1. To perform no load and blocked rotor tests on a three-phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three-phase induction motor and draw: Torque -speed characteristics
3. To perform no load and blocked rotor tests on a single-phase induction motor and determine equivalent circuit parameters and efficiency.
4. To study of speed control of three phase induction motor by (i) pole changing (ii) Supply voltage and (iii) frequency control method
5. To study speed control of three phase slip ring induction motor by rotor emf injected method.
6. To perform open circuit and short circuit tests on a three-phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging by (i) Synchronous Impedance method and (ii) MMF method.
7. To perform V-curves and inverted V-curves of a three-phase synchronous motor.
8. To determine X_d and X_q of a three-phase salient pole synchronous machine using the slip test and draw the power-angle characteristics.
9. To study synchronization of an alternator with the infinite bus by using: dark lamp method (ii) two bright and one dark lamp method.
10. To study speed-torque characteristics of three phase slip ring induction motor and effects of additional resistance, or capacitance in the rotor circuit.
11. To study VSI based slip power recovery scheme of three phase induction motor
12. To study performances of three phase Induction Generator.

Books & References

1. D. P. Kothari & I. J. Nagrath, "Electric Machines", Tata McGraw Hill
2. Ashfaq Hussain "Electric Machines" DhanpatRai& Company
3. Fitzerald, A. E., Kingsley and S. D. Umans "Electric Machinery", MC Graw Hill.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Published.
5. P. S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers.
6. M. G. Say, "Alternating Current Machines", Pitman& sons.

BEE-27 POWER SYSTEM-I

Course category:	Department Core (DC)
Pre-requisite Subject:	Electrical Circuits and Analysis
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, One Minor test, and One Major Theory Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basic Layout of power system.
2. The concept of supply system
3. The analysis of O/H Transmission lines
4. The understanding of EHVAC & HVDC Transmission lines.
5. The Corona, insulator, neutral grounding & mechanical design of Transmission line.

Topics Covered

UNIT-I **9L**

Power System Components:
Single line Diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator.
Supply System:
Different kinds of supply system and their comparison, choice of transmission voltage
Transmission Lines:
Configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect

UNIT-II **9L**

Over Head Transmission Lines:
Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, Representation and performance of short, medium, and long transmission lines, Ferranti effect. Surge impedance loading
EHV AC and HVDC Transmission:
Introduction to EHV AC and HVDC transmission and their comparison, use of bundle conductors, kinds of DC links, and incorporation of HVDC into AC system

UNIT-III **9L**

Corona and Interference:
Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference. Electrostatic and electromagnetic interference with communication lines
Overhead line Insulators:
Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency
Insulated cables:
Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables

UNIT-IV **9L**

Mechanical Design of transmission line:
Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration, Dampers

Electrical Design of Transmission Line:
Design consideration of EHV transmission lines, choice of voltage, number of circuits, conductor configuration, insulation design, selection of ground wires.

Neutral grounding:
Necessity of neutral grounding, various methods of neutral grounding, earthing transformer, grounding practices

Books & References

1. W. D. Stevenson, "Element of Power System Analysis", McGraw Hill,
2. C. L. Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition
3. AsfaqHussain, "'Power System", CBS Publishers and Distributors,
4. B. R. Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.
5. M. V. Deshpande, "Electrical Power System Design" Tata McGraw Hill.
6. M. V. Deshpandey, "Elements of Power System Design", Tata McGraw Hill,
7. Soni, Gupta &Bhatnagar, "A Course in Electrical Power", Dhanpat Rai& Sons,
8. S. L. Uppal, "Electric Power", Khanna Publishers
9. S.N. Singh, "Electric Power Generation, Transmission& distribution." PHI Learning

BEE-28 CONTROL SYSTEM ENGINEERING

Course category:	Department Core (DC)
Pre-requisite Subject:	Electrical Circuits and Analysis
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basic Block diagram of control system.
2. The control system components.
3. The analysis of time response.
4. The analysis of frequency response.
5. The Compensator designs.

Topics Covered

UNIT-I **9L**

Control System Introduction and Mathematical Modelling:
Open loop & closed control; servomechanism; Mathematical modelling of physical systems; Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula, Reduction of parameter variation and effects of disturbance by using negative feedback.

UNIT-II **9L**

Control System Components:
Constructional and working principles of AC & DC servomotors, stepper motor, and synchro's, error detectors. Basic control actions: proportional (P), integral (I), derivative (D), and PID controllers.
Concept of Stability: Stability concepts, algebraic criteria, and necessary conditions, Routh-Hurwitz criteria, and limitations.

UNIT-III **9L**

Time Response analysis:
Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants.
Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems, performance indices. Root Locus Technique: The root locus concepts, construction of root loci.

UNIT-IV **9L**

Frequency response Analysis:
Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots.
Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability, gain margin and phase margin, constant M&N circles.

EXPERIMENTS

1. Study Metaldyne cross-field generator. Determine its transfer function.
2. Determine transfer function of dc generator. Study behaviour of dc generator in open loop and closed loop conditions at various loads.
3. Determine transfer function of dc motor. Study behaviour of dc motor in open loop and closed loop conditions at various loads.
4. Study DC position control system and determine speed-torque characteristics of ac servomotor.
5. Study AC position control system and determine speed-torque characteristics of ac servomotor.
6. Study PID control using linear simulator unit and determine step input response of first order and second order systems.

7. Study synchros. Determine synchros-transmitter characteristics. Configure synchro-transmitter and synchro-control transformer unit as error detector and obtain output vs input characteristics.
8. Study stepper motor from its characteristics and applications point of view.

Books & References

1. I. J. Nagrath and M. Gopal, "Control System Engineering", 4th Edition, New age International.
2. M. Gopal, "Control Systems: Principles and Design", Tata McGraw-Hill Education, 2002.
3. K. Ogata, "Modern Control Engineering", Pearson Education, 4th Indian reprint.
4. B. C. Kuo and Farid Golnaraghi, "Automatic Control System" Wiley India Ltd, 2008.
5. D. Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.
6. Ajit K. Mandal, "Introduction to Control Engineering" New Age International, 2006.

BEE-29 INSTRUMENTATION & PROCESS CONTROL

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basic concept of instrumentation and its industrial application and working & performances of different kind of measuring instruments.
2. Ability to analyze performance characteristics of measuring instruments.
3. Ability to know, working principle & Performances of different electrical transducers.
4. Ability to understand construction, principle of operation, working and applications of waveform analyzers and spectrum analyzers, CRO and other display devices.
5. Ability to understand principle of operation of telemetry system and data acquisition system.
6. Ability to understand principle of operation of process control system and its various elements

Topics Covered

UNIT-I **9L**

Fundamentals of Transducers

Generalized input-output configuration of instrumentation, Dynamic performance characteristics of instruments, order of systems (zero, first, seconds order systems), Transfer functions, Advantages of electrical transducers, definition, description, classification, characteristics, factors affecting the choice of transducers, Sensors & pick-ups.

UNIT-II **9L**

Transducers for Measurement of Non-Electrical Quantities

Introduction to resistive, inductive & capacitive transducers. Transducers for measurement of displacement, velocity, acceleration, force, pressure, temperature, humidity, moisture, flow and liquid level monitoring & control. Piezoelectric, Piezoresitive, Photo voltaic, Hall effect, fibre optic and opto- electronic transducers,

UNIT-III **9L**

Telemetry, Data Acquisition System, Recorders & Display Devices

General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter, TDM &, FDM. Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system. Display devices, storage oscilloscope, Strip chart & X-Y recorders, magnetic tape & digital tape recorders.

UNIT-IV **9L**

Process Control

Principle, elements of process control system, process characteristics, ON-OFF controller, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers. Role of computer instrumentation and process control

EXPERIMENTS

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge-based displacement transducer.
3. Measurement of displacement using LDR.
4. Measurement of speed of motor using magnetic pickup &photoelectric pickup.
5. Measurement of speed of motor using stroboscope.
6. Measurement of load using strain gauge-based load cell.
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple.
9. Measurement of weight of unknown sample using inductive transducers.
10. Study of P, PI and PID controllers.
11. Study of storage oscilloscope and determination of transient response of RLC circuit.
12. Study of signal conditioning circuit for any transducer

13. Study of data acquisition system using "**Lab View**" software and test all signal points
14. Measurement of sine, triangular, square wave signal of function generator and verify its frequency at 100 Hz tap point using "**Lab View**" software.

Books & References

1. A. K. Sawhney, "Advanced Measurements & Instrumentation", DhanpatRai& Sons
2. B.C. Nakra & K. Chaudhry, "Instrumentation, Measurement and Analysis", Tata McGraw Hill 2nd Edition.
3. Curtis Johns, "Process Control Instrumentation Technology", Prentice Hall
4. E.O. Decblin, "Measurement System – Application & design", McGraw Hill.
5. W.D. Cooper and A.P. Beltried, "Electronics Instrumentation and Measurement Techniques" Prentice Hall International
6. Rajendra Prasad," Electronic Measurement and Instrumentation Khanna Publisher
7. M.M.S. Anand, "Electronic Instruments and Instrumentation Technology" PHI Learning.

BEE-31 POWER SYSTEM-II

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The L and C expressions for various configurations and analyze different types of Transmission lines
2. The Traveling wave theory and derive expressions for reflection and refraction coefficients with various terminations of the lines
3. The analysis symmetrical as well as unsymmetrical faults.
4. Load flow analysis.
5. The concept of Power system stability

Topics Covered

UNIT-I **9L**

Representation of Power System Components:
Synchronous machines, Transformers, Transmission lines, One line diagram, Impedance and reactance diagram, per unit System

Symmetrical components, Symmetrical & Unsymmetrical faults:
Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks. Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions
Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance.
Formation of Z-bus using singular transformation and algorithm, computer method for short circuit calculations

UNIT-II **9L**

Load Flows:
Introduction, bus classifications, nodal admittance matrix (BUS Y), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method.

UNIT-III **9L**

Power System Stability:
Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.

UNIT-IV **9L**

Traveling Waves:
Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection, and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipment and line against traveling waves.

EXPERIMENTS

(A) Hardware Based:

1. To determine direct axis reactance (xd) and quadrature axis reactance (xq) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (xd) and sub transient quadrature axis reactance (xq) of an alternator
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
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 determine location of fault in a cable using cable fault locator
9. To study ferranty effect and voltage distribution in H.V. long transmission line using transmission line model.
10. To study operation of oil testing set.

Simulation Based Experiments (using MATLAB or any other software)

11. To determine transmission line performance.
12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To obtain formation of Y-bus and perform load flow analysis
14. To perform symmetrical fault analysis in a power system
15. To perform unsymmetrical fault analysis in a power system

Books & References

1. W.D. Stevenson, Jr. "Elements of Power System Analysis", McGraw Hill.
2. C.L. Wadhwa, "Electrical Power System", New Age International.
3. Chakraborthy, Soni, Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
4. T. K. Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press, 2007.
5. L. P. Singh; "Advanced Power System Analysis & Dynamics", New Age International
6. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.
7. D. Das, "Electrical Power Systems" New Age International, 2006.
8. J.D. Glover, M.S. Sharma & T. J. Overbye, "Power System Analysis and Design" Thomson, 2008.
9. P.S.R. Murthy "Power System Analysis" B.S. Publications,2007.
10. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata McGraw Hill
11. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill.

BEE-32A POWER ELECTRONICS

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The working principle of various Power semiconductor devices.
2. The concept of phase-controlled converters.
3. The analysis of inverters in various configuration and elimination of harmonics.
4. The concepts of DC choppers, AC voltage controllers & cycloconverters for various applications. The concept of Power system stability

Topics Covered

UNIT-I **9L**

UNIT I

Power semiconductor Devices:

Power semiconductor Devices, their symbols and static characteristics, characteristics, types of Power Electronics Circuits, operation, steady state & switching characteristics of power transistors (BJT), operation of Power MOSFET and IGBT, Thyristor operation, V-I characteristics, Two transistor model, methods of turn-on, Operation of GTO, MCT and TRIAC, Protection of thyristors.

UNIT-II **9L**

(i) Series and parallel operation of thyristors

(ii) Inverters

Voltage source inverters, single phase series resonant inverter, single phase bridge inverters, three Phase bridge inverters, voltage control of inverters, harmonics reduction techniques, single phase and three phase current source inverters.

UNIT-III **9L**

Phase controlled converters:

Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode, single phase fully controlled and half controlled bridge converters, performance parameters, three phase half wave converters, three phase fully controlled and half controlled bridge converters, effect of source impedance, single phase and three phase dual converters, Cyclo-converters; basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo-converters, output voltage equation .

UNIT-IV **9L**

AC Voltage Controllers:

Principle of on-off and phase control, single phase ac voltage controller with resistive and inductive loads, three phase ac voltage controllers (various configurations and comparison only), single phase transformer taps changer. DC-DC converters: classification of chopper,

principles of step-down chopper, step down chopper with R-L-E load, principle of step-up chopper and operation with RL load.

EXPERIMENTS

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single phase half wave-controlled rectifier with (i) resistive load, (ii) inductive load with and without freewheeling diode.
4. To study single phase (i) fully controlled (ii) half-controlled bridge rectifiers with resistive and inductive loads
5. To study three phase fully /half-controlled bridge rectifier with resistive and inductive loads.
6. To study single phase ac voltage regulator with resistive and inductive loads.
7. To study single phase cycloconverter
8. To study triggering of (i) IGBT, (ii) MOSFET, &(iii) Power transistor
9. To study operation of IGBT/MOSFET chopper circuit.
10. To study MOSFET/IGBT based single phase series resonant inverter.
11. To study MOSFET/IGBT based single phase bridge inverter.

Books & References

1. M. H. Rashid, "Power Electronics Circuits, Devices & Application" Prentice Hall of India Ltd. 4th Edition 2018.
2. M.D. Singh and K.B. Khanchandani "Power Electronics" Tata McGraw Hill,2005
3. V.R. Moorthy "Power Electronic Devices circuits and Industrial Applications" Oxford University Press, 2007
4. P. S. Bimbhra "Power Electronics" Khanna Publisher, New Delhi, 2010.
5. Chakrabarti & Rai "Fundamental of Power Electronics & Drives" Dhanpat Rai & sons.

BEE-33 POWER PLANT ENGINEERING

Course category:	Department Core (DC)
Pre-requisite Subject:	Power System-I
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concept of conventional & non-conventional source of energy.
2. The general layout, principle, working & performance of a steam power plant.
3. The general layout, principle, working & performance of a Hydro-electric power plant.
4. The general layout, principle, working & performance of a Diesel power plant.

Topics Covered

UNIT-I **9L**

Introduction:
Power and energy, sources of energy, fuels, energy stored in water, nuclear energy, wind energy, solar energy, tidal power, thermo-electric power, Geothermal energy Load estimation, load curves, Selection of power plant units, Power plant economics, Effect of plant type on costs, rates

UNIT-II **9L**

Steam Power Plant:
Classification of steam power plant, general layout of steam power plant, Power plant boilers, Coal handling system, pulverisers and coal burners, combustion system, ash handling system, Steam turbines, steam condensers, dust collection system, Feed water treatment, Steam turbines, auxiliary systems, governing, reheating, Operation and maintenance of steam power plant, Site selection of a steam power plant.

UNIT-III **9L**

Phase controlled converters:
Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode, single phase fully controlled and half controlled bridge converters, performance parameters, three phase half wave converters, three phase fully controlled and half controlled bridge converters, effect of source impedance, single phase and three phase dual converters, Cyclo-converters; basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo-converters, output voltage equation .

UNIT-IV **9L**

Diesel Power Plant:
General layout, Components of Diesel power plant, site selection, heat engines, classifications of I.C engines, Performance of diesel power plant, fuel system, lubrication system, air intake system, exhaust system, Comparative study of diesel engine and petrol engine, merits and demerits of diesel power plants, applications of diesel power plant

Books & References

1. "Power Plant Engineering" F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras.
2. "Power Plant Engineering" Mahesh Verma, Metropolitan Book Company Pvt. Ltd. New Delhi.
3. "Power System Engineering" R.K Rajput, Laxmi Publication Ltd. New Delhi
4. Power Plant Engineering by P.K. Nag, Tata McGraw Hill. New Delhi.

BEE-30 SEMINAR

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 6
Number of Credits:	3
Course Assessment methods:	Continuous assessment through quality of material, presentation, quality & extent of external response of question asked and participation in other seminars (attendance).
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Engage students in the integrated activities of reading, research, discussion, and composition around a designated subject.
2. Identify, understand and discussion current, real-world issues.
3. Improve oral and written communication skills.
4. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
5. Apply principles of ethics and respect in interaction with others.

BEE-42 SWITCH GEAR AND PROTECTION

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2

Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Student gains knowledge on different Protective Equipment's of Power Systems
2. Know about various protective systems- how it works and where it works?
3. Student gains knowledge on different Protective Equipment's of Power Systems
4. Different applications of the relays, circuit breakers, grounding for different elements of power system are also discussed in the subject.
5. Ability to discuss Recovery and Restricting.
6. Ability to express Oil circuit Breaker, Air Blast circuit Breakers, SF6 Circuit Breaker.
7. Ability to identify DMT, IDMT type relays**.**

Topics Covered

UNIT-I **9L**

Protective Relaying Fundamentals & Relays
Introduction to protection system and its elements, Functional Characteristics of protective relaying, Protective zones, Primary and Backup protection, desirable qualities of protective relaying, basic terminology sealing/auxiliary relay. Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay.

UNIT-II **9L**

Relay Applications/Characteristics & Static Relays:
Over current relays, directional relays, distance relays, differential relay**.** Amplitude and phase comparators. Comparison between electromagnetic & static relays, classification, and description of static relays.

UNIT-III **9L**

Protection of Transmission Line & Power Apparatus
Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus bar, auto re-closing. Protection scheme for power transformers, generators, and motors.

UNIT-IV **9L**

Circuit Breaking Theories & Circuit Breakers:
Properties of arc, arc extinction theories, re-striking voltage transient, current chopping,

resistance switching, capacitive current interruption, operating modes, selection of circuit breakers. Constructional features and operation of Air, Bulk Oil, Minimum Oil, Air Blast, SF_6, and Vacuum Circuit breakers, Ratings &Testing of Circuit Breakers.

EXPERIMENTS

1. To study the IDMT over current relay and determine the time current characteristics.
2. To study percentage differential relay.
3. To study Impedance, MHO and Reactance type distance relays.
4. To study the working and principle of operation of Buchholz relay.
5. To understand the protection scheme of transformer through visit to local high voltage substation and to sketch labelled schematic diagram of various type of protection of transformer.
6. To understand the protection scheme using static relaying of nearby high voltage substation through visit and to sketch labelled schematic diagram.
7. To understand the protection scheme of alternator and to sketch labelled schematic diagram of various type of protection of alternator.
8. To understand various type of neutral earthling and specifications of earthling at different substations/locations and new trends in earthling schemes (information search).
9. To identify the components of different type of circuit breakers with their specifications (through/video/manuals)
10. To study operation of oil testing set and find out the break down strength of given oil sample.

Books & References

1. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
2. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.
3. B. Bhalja, R.P. Maheshwari& N. G. Chothani, Protection & Switch Gear, Oxford University Press.
4. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill
5. Y. G. Paithankar and S. R. Bhide, "Fundamentals of Power System Protection", Prentice Hall of India.
6. T.S.M Rao, "Power System Protection: Static Relays with Microprocessor Applications" Tata Mcgraw Hill".
7. A.R. Van C. Warringtaon, "Protective Relays- Their Theory and Practice, Vol. I & II" Jhon Willey & Sons.

BEE-43 POWER SYSTEM OPERATION AND CONTROL

Course category: Department Core (DC)

Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Ability and understanding of Energy control centre, analysis of real time control of power system parameters, learn about SCADA system
2. Ability to solve load dispatch problems with computer aided techniques for economy load dispatch.
3. Ability to analysis of real & reactive power control, load frequency control & Interconnected power systems
4. Ability to analysis of automatic excitation control systems and explore static and dynamic responses of system.
5. Ability to explain the importance of FACTS devices & their controllers.

Topics Covered

UNIT-I **9L**

Introduction:
Overview of power system operation, Energy control centre and real time computer control, SCADA system, power system operation and control in India, system security, voltage stability, role of information technology in energy control system, contingency analysis, system states and transient diagrams

UNIT-II **9L**

Economic Operation:
Energy demand, demand factor, load factor, diversity factor, types of loads, Economic operation of power system and unit commitment, Input-output characteristics of power plants, Economy loading with and without transmission losses, Penalty factor, computerized approach for economy load dispatch.

UNIT-III **9L**

Load Frequency Control:
Role of system frequency in real power control, Concept of load frequency control, control area concept, single area and multi area load frequency control scheme, steady state and

dynamic response, Automatic load frequency control for interconnected power systems, Automatic load dispatching

UNIT-IV **9L**

Voltage and Reactive Power control:
Schematic diagram and block diagram representation, automatic excitation control systems, static and dynamic response, low power factor causes, improvement in power factor, concept of real and reactive power, Shunt compensation, series compensation, Flexible AC Transmission Systems**:** Concept and objectives of FACTS controllers, Working & Characteristics of different FACTS Controllers.

Books & References

1. D. P. Kothari & I. J. Nagrath, "Modern Power System Analysis" Tata McGraw Hill, 3rd Edition.
2. P.S.R. Murty, "Operation and control in Power Systems" B.S. Publications.
3. N. G. Hingorani & L. Gyugyi, "Understanding FACTs" Concepts and Technology of Flexible AC Transmission Systems"
4. J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control "John Wiley Sons.
5. O. I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
6. P. Kundur, "Power System Stability and Control McGraw Hill.
7. M. H. Rashid, "Power Electronics: Circuits, devices and Applications" Prentice Hall of India,3rd Edition.
8. T. K. Nagsarkar & M. S. Sukhiza,' Power System Analysis' Oxford University Press.

BEE-44 UTILIZATION AND TRACTION

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Advantages and methods of electrical heating, concept of resistance heating, electrical arc heating, induction heating and dielectric heating
2. Knowledge of electric arc welding, resistance welding and electronic welding control, laws of electrolysis, concept of electro deposition and application of electrolysis
3. Laws of illumination, requirement of good lighting, design of indoor and outdoor lighting, concept of refrigeration and air conditioning systems, domestic refrigerator and water cooler, concept of window air conditioner
4. Knowledge of types of electric traction, system of electrification, traction mechanism, speed time curve specific energy consumption mechanism of train movement, coefficient of adhesion and its influence
5. Salient features of traction drives, series parallel control of traction drives and energy saving, power electronic control dc and ac traction drives, diesel electric traction

Topics Covered

UNIT-I **9L**

Electric Heating:
Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating**,** Electric Arc Welding, Electric Resistance welding, electronic welding control, Principles of electro deposition, Laws of electrolysis, applications of electrolysis

UNIT-II **9L**

Illumination:
Various definitions, Laws of illumination, requirements of good lighting, Design of indoor lighting and outdoor lighting systems, Refrigeration systems, domestic refrigerator, water cooler, Types of air conditioning, Window air conditioner

UNIT-III **9L**

Electric Traction:
Types of electric traction, systems of track electrification, types of services, speed time curve and its simplification, average and schedule speeds, Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence

UNIT-IV **9L**

Modern Electric Traction
Salient features of traction drives, Series – parallel control of dc traction drives (bridge transition) and energy saving, Power Electronic control of dc and ac traction drives, Diesel electric traction.

Books & References

1. H. Partab, "Art and Science of Electrical Energy" Dhanpat Rai& Sons.

2. G. K. Dubey, "Fundamentals of Electric Drives" Narosa Publishing House
3. H. Partab, "Modern Electric Traction" Dhanpat Rai& Sons.
4. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy" New Age International Publications.

BEE-40 PROJECT PART-I

Course category:	Project (P)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 10
Number of Credits:	5
Course Assessment methods:	Continuous assessment through one viva voce/presentation, preliminary project report, effort and regularity and end semester presentation
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Ability to learn, design & analysis of electrical engineering system modules.
2. Development of hardware based electrical engineering module.
3. Development of software-based simulation module.
4. Innovative tool-based research work in electrical engineering.

BEE-45 INDUSTRIAL TRAINING

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 2
Number of Credits:	1
Course Assessment methods:	Continuous assessment through technical quality of the work, attendance, discipline, involvement and interest, project work, viva voce, project report and presentation
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Demonstrate competency in relevant engineering fields through problem identification, formulation, and solution.
2. Effectively implement skills in communication, writing, designing and development of multimedia tools.
3. Develop the ability to work as an individual and in group with the capacity to be a leader or manager as well as an effective team member.
4. Master the professional and ethical responsibilities as an electrical engineer.

BEE-41 ELECTRIC DRIVES

Course category:	Department Core (DC)
Pre-requisite Subject:	Power Electronics (BEE-32A)
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Knowledge of electric drive and its parts, significance of power modulator electric motors, sensing units, loads and control units in electric drives, advantages, and classification of electric drive, multi quadrant operation of the drive
2. Knowledge of dynamic behaviour of motor, transient and steady state behaviour of drives
3. Knowledge of thermal model of the drive, classes of motor duties and technique to calculate the rating of the drive for various duty cycles, overloading factor estimation and load equalization.
4. Purpose and types of braking, significance and application of different electrical braking, energy loss during starting and braking
5. Control of separately excited and dc series motor dc drive by single phase and three phase converter, dual converter control of dc drive, applications and limitations of various control, chopper control of dc series and servo motor
6. Static control of dc motor by single phase, three phase and dual converters. chopper control of dc series and servomotor, idea, and effect of supply harmonics
7. Static control of three phase induction motor by CSI, VSI and Cycloconverter, static voltage and frequency control, static rotor resistance control and slip power recovery scheme, selection of motor for application
8. Constructional features, working and of switched reluctance and brush less motor, selection of motor for particular services

Topics Covered

UNIT-I **9L**

Introduction to Electric Drives:
Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed-torque conventions and multi-quadrant operations, Constant torque, and constant power operation. Types of load torque components, nature, and classification. Dynamics of motor-load combination; Steady state stability of Electric Drive; Transient stability of electric Drive, Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty, Load equalization

UNIT-II **9L**

Braking of Electrical Machines:
Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors, Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking.

UNIT-III **9L**

Power Electronics Control of DC Drives:
Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics, power factor and ripples in motor current, Chopper control of separately excited dc motor and dc series motor**.**

UNIT-IV **9L**

Power Electronics Control of AC Drives & Special Machine:
Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes. Self-controlled scheme of synchronous motor drive, Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications.

EXPERIMENTS

Note: - Minimum 10 experiments are to be performed
Hardware Based Experiments

1. To study speed control of separately excited dc motor by varying armature voltage using single-phase fully controlled bridge converter.
2. To study speed control of separately excited dc motor by varying armature voltage using single phase half-controlled bridge converter.
3. To study speed control of separately excited dc motor using single phase dual converter (Static Ward-Leonard Control).

4. To study speed control of separately excited dc motor using MOSFET/IGBT chopper.
5. To study closed loop control of separately excited dc motor.
6. To study speed control of single-phase induction motor using single phase ac voltage controller.
7. To study speed control of three phase induction motor using three phase ac voltage controller.
8. To study speed control of three phase induction motor using three phase current source inverter
9. To study speed control of three phase induction motor using three phase voltage source inverter
10. To study speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper
11. To study speed control of three phase slip ring induction motor using static scherbius slip power recovery control scheme

Simulation Based Experiments (using MATLAB or any other software)

1. To study starting transient response of separately excited dc motor
2. To study speed control of separately excited dc motor using single phase fully / half-controlled bridge converter in discontinuous and continuous current modes.
3. To study speed control of separately excited dc motor using chopper control in motoring and braking modes.
4. To study starting transient response of three phase induction motor
5. To study speed control of three phase induction motor using (a) constant/V/F control (b) Constant Voltage and frequency control.

Books & References

1. G.K. Dubey, “Fundamentals of Electric Drives” Narosa publishing House.
2. S. K. Pillai, “A First Course on Electric Drives” New Age International.
3. M. Chilkin, “Electric Drives”, Mir Publishers, Moscow.
4. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
5. N.K. De and Prashant K. Sen, “Electric Drives”, Prentice Hall of India Ltd.
6. Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill.

BEE-46 POWER QUALITY

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4

Course Assessment methods: Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Acquire the knowledge of different terms and definitions of power quality.
2. Gains knowledge on causes and effects of voltage sags and its mitigations.
3. Gains knowledge on power system transients and harmonics with their effects and mitigation techniques.
4. Know about various power quality measuring, analyzing and testing devices.
5. Get introductory knowledge of custom power devices for further knowledge enhancement

Topics Covered

Introduction to Power Quality:
Terms and definitions of transients, Long Duration Voltage Variations: under Voltage, Under Voltage and Sustained Interruptions**;** Short Duration Voltage Variations: interruption, Sag, Swell; Voltage Imbalance; Notching D C offset, waveform distortion; voltage fluctuation; power frequency variations**.**

UNIT-II **9L**

Voltage Sag:
Sources of voltage sag: motor starting, arc furnace, fault clearing etc; estimating voltage sag performance and principle of its protection; solutions at end user level- Isolation Transformer, Voltage Regulator, Static UPS, Rotary UPS, Active Series Compensator.

UNIT-III **9L**

Electrical Transients:
Sources of Transient Over voltages- Atmospheric and switching transients- motor starting transients, pf correction capacitor switching transients, ups switching transients, neutral voltage swing etc; devices for over voltage protection.
Harmonics: Causes of harmonics; current and voltage harmonics: measurement of harmonics; effects of harmonics on – Transformers, AC Motors, Capacitor Banks, Cables, and Protection Devices, Energy Metering, Communication Lines etc. harmonic mitigation techniques.

UNIT-IV **9L**

Measurement and Solving of Power Quality Problems:

Power quality measurement devices- Harmonic Analyzer, Transient Disturbance Analyzer, wiring and grounding tester, Flicker Meter, Oscilloscope, multimeter etc.
Introduction to Custom Power Devices-Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner.

Books & References

1. Roger C Dugan, Mc Grahan, Santoso & Beaty, "Electrical Power System Quality" McGraw Hill
2. Arinthom Ghosh& Gerard Ledwich, "Power Quality Enhancement Using Custom Power Devices" Kluwer Academic Publishers
3. C. Sankaran, "Power Quality" CRC Press.

BEE-50 PROJECT PART-II

Course category:	Project (P)
Pre-requisite Subject:	Project Part-1 (BEE-40)
Contact hours/week:	Lecture: 0, Tutorial: 0, Practical: 10
Number of Credits:	5
Course Assessment methods:	Continuous assessment through one viva voce/presentation, final project report, contribution made to literary world and Major Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Ability to learn, design & analysis of electrical engineering system modules.
2. Development of hardware based electrical engineering module.
3. Development of software-based simulation module.
4. Innovative tool-based research work in electrical engineering.

SUBJECTS OFFERED TO OTHER DEPARTMENTS

BEE-01 PRINCIPLES OF ELECTRICAL ENGINEERING

Course category:	Department core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2

Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to understand the basic concepts of network and circuit.
2. To solve the basic electrical circuits.
3. Familiarity with the basic concepts of AC circuits.
4. Introductory concept of measurement, instrumentation, working & performances of different kind of measuring instruments (PMMC, MI).
5. Able solve magnetic circuits.
6. Able to analyze three phase circuits.
7. Introduction and application to different electrical machines.

Topics Covered

UNIT-I **9L**

D C Circuit Analysis and Network Theorems:
Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation Kirchhoff's laws; Loop and nodal methods of analysis; Star-delta transformation Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem.

UNIT-II **9L**

Steady- State Analysis of Single-Phase AC Circuits:
AC fundamentals: Sinusoidal, square, and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit
Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power, and its measurement

UNIT-III **9L**

Measuring Instruments, Magnetic Circuit & Single-phase Transformers
Types of instruments, Construction and working principles of PMMC and Moving Iron type voltmeters & ammeters, Use of shunts and multipliers.

Magnetic circuit, concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.
Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, Introduction to auto transformer.

UNIT-IV **9L**

Electrical Machines:
Concept of electromechanical energy conversion DC machines: Types, EMF equation of generators and torque equation of motor, Characteristics, and applications of DC Generators & motors.
Three Phase Induction Motor: Types, Principle of operation, Torque-slip characteristics, Applications
Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.
Three Phase Synchronous Machines: Principle of operation of alternator, EMF equation, Principle of operation and starting of synchronous motor, their applications.

EXPERIMENTS

1. Verification of Kirchhoff's law
2. Verification of Norton's theorem
3. Verification of Thevenin's theorem
4. Verification of Series R-L-C circuit
5. Verification of Parallel R-L-C circuit
6. Measurement of Power and Power factor of three phase inductive load by two wattmeter methods
7. To draw the magnetization characteristics of separately excited dc motor.
8. To perform the external load characteristics of dc shunt motor.
9. To perform O.C. and S.C. test of a single-phase transformer

Books & References

1. "Principles of Electrical Engineering", V. Del Toro; Prentice Hall International
2. "Basic Electrical Engineering", D P Kothari, I.J. Nagarath; Tata McGraw Hill
3. "Basic Electrical Engineering", S N Singh; Prentice Hall International
4. "Fundamentals of Electrical Engineering" B Dwivedi, A Tripathi; Wiley India
5. "Electrical and Electronics Technology", Edward Hughes; Pearson

BEE-16 ELECTROMECHANICAL ENERGY CONVERSION

Course category:	Department Core (DC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2

Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts DC machines with numerical calculation.
2. The concept of Transformer with numerical calculation.
3. The concept of Synchronous machine & IM with numerical calculation.

Topics Covered

UNIT-I **9L**

DC Machines:
Construction of DC Machines, Armature winding, EMF and torque equation, Armature Reaction, Commutation, Interpoles and Compensating Windings, Performance Characteristics of D.C. generators, Performance Characteristics of D.C. motors, Starting of D.C. motors; 3-point and 4-point starters, Speed control of D.C. motors: Field Control, armature control and Voltage Control (Ward Lenonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburn's Test).

UNIT-II **9L**

Transformers:
Principle of operation, Construction, Phasor diagram, efficiency, and voltage regulation of 1-phase transformer, O.C. and S.C. tests, Sumpner's test, polarity test. Single phase and three phase auto transformers, volt-amp, relation, efficiency, merits & demerits, and applications, three phase to 2 phase, 6 phase or 12 phase connections, and their applications.

UNIT-III **9L**

Induction Motors:
Constructional features of 3-phase induction motor, Rotating magnetic field, Principle of operation, Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Starting, Speed Control (with and without EMF injection in rotor circuit.) Constructional features and working of 1-phase induction motor, Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, starting methods.

UNIT-IV **9L**

Synchronous Machines:
Constructional features and working of 3-phase Alternator, Armature winding, EMF

Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage Regulation using Synchronous Impedance Method, MMF Method, Potier's Triangle Method, Two Reaction Theory, Power flow equations of cylindrical and salient pole machines, operating Characteristics, Starting methods of 3-phase synchronous motor, Effect of varying field current at different loads, V- Curves.

EXPERIMENTS

1. To obtain magnetization characteristics of a DC shunt generator
2. To obtain load characteristics of a DC shunt generator
3. To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control.
4. Determine V-curves and inverted V-curves of a three-phase synchronous motor.
5. To obtain equivalent circuit, efficiency and voltage regulation of a single-phase transformer using O.C. and S.C. tests.
6. To obtain efficiency and voltage regulation of a single-phase transformer by Sumpner's test.
7. To study polarity and ratio test of single phase and 3-phase transformers
8. To perform no load and blocked rotor tests on a three-phase squirrel cage induction motor and determine equivalent circuit.
9. To perform no load and blocked rotor tests on a single-phase induction motor and determine equivalent circuit.
10. To perform open circuit and short circuit tests on a three-phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by Synchronous Method
11. Determine V-curves and inverted V-curves of a three-phase synchronous motor.

Books & References

1. I.J. Nagrath & D. P. Kothari," Electrical Machines", Tata McGraw Hill
2. Husain Ashfaq, "Electrical Machines", Dhanpat Rai & Sons
3. A.E. Fitggerald, C. KingsleyJr and Umans, "Electric Machinery" 6th Edition McGraw Hill, International Student Edition.
4. B.R. Gupta &Vandana Singhal, "Fundamentals of Electrical Machines, New Age International.
5. Irving L. Kosow, "Electric Machine and Tranformers", Prentice Hall of India.
6. M. G. Say, "The Performance and Design of AC machines", Pit man & Sons.
7. Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" Oxford University Press, 2001.
8. P. S. Bimbhra, "Electrical Machinery", Khanna Publisher
9. P. S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers

BOE-10 NON-CONVENTIONAL ENERGY RESOURCES

Course category: Open Elective (OE), EED

Pre-requisite Subject: NIL

Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Various non-conventional energy resources.
2. The concept of Solar Thermal Energy.
3. The concept of Geothermal Energy & Wind Energy Generation.

Topics Covered

UNIT-I **6L**

Introduction
Various non-conventional energy resources- Introduction, availability, classification, relative merits, and demerits.
Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.
Bio-mass: Availability of bio-mass and its conversion theory.

UNIT-II **6L**

Solar Thermal Energy:
Solar radiation, flat plate collectors and their materials, applications, and performance, focusing of collectors and their materials, applications, and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.
Thermo-electrical and thermionic Conversions: Principle of working, performance, and limitations.

UNIT-III **6L**

Geothermal Energy:
Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.
Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance, and limitations.
Fuel Cells: Principle of working of various types of fuel cells and their working, performance, and limitations.

UNIT-IV **6L**

Wind Energy:

Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance, and limitations.

Wave and Tidal Wave: Principle of working, performance, and limitations. Waste Recycling Plants.

Books & References

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. KoteswaraRao, "Energy Resources: Conventional & Non-Conventional" BSP Publications, 2006.
4. D.S. Chauhan, "Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

BOE-11 FUNDAMENTALS OF ELECTRIC DRIVES

Course category:	Open Elective (OE), EED
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts of basic electric drives & its dynamics.
2. The concept of Motor power rating, Braking and Calculation of Energy loss.
3. The concept of Power Electronic Control of DC Drives.
4. Power Electronic Control of AC Drives, Special Drives & Application of Motors.

Topics Covered

UNIT-I **6L**

Basic Electric Drives and its Dynamics

Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed-torque conventions and multi-quadrant operations, group drives and individual drives, Constant torque and constant power operation. Types of load torque components, nature, and classification. Dynamics of motor-load combination; Steady state stability of Electric Drive; Load equalization

UNIT-II **6L**

Motor power rating, Braking and Calculation of Energy loss
Thermal model of motor for heating and cooling, classes of motor duty, determination motor power rating for continuous duty, short time duty and intermittent duty. Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors, Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors.

UNIT-III **6L**

Power Electronic Control of DC Drives:
Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Chopper control of separately excited dc motor and dc series motor**.**

UNIT-IV **6L**
Power Electronic Control of AC Drives, Special Drives & Application of Motors
Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI) static rotor resistance and slip power recovery control schemes. Brushless dc motor. Selection of motor for particular applications

Books & References

1. G.K. Dubey, "Fundamentals of Electric Drives", Narosa publishing House.
2. S. K. Pillai, "A First Course on Electric Drives", New Age International.
3. M. Chilkin, "Electric Drives", Mir Publishers, Moscow.
4. Mohammed A. El-Sharkawi, "Fundamentals of Electric Drives", Thomson Asia, Pvt. Ltd. Singapore.
5. N.K. De and Prashant K. Sen, "Electric Drives", Prentice Hall of India Ltd.
6. V. Subrahmanyam, "Electric Drives: Concepts and Applications", Tata McGraw Hill.

PROGRAMME ELECTIVES (ELECTRICAL ENGINEERING)

BCS-36 DATABASE MANAGEMENT SYSTEM, DATA MINING &WAREHOUSING

Course category: Program Elective (PE1)

Pre-requisite Subject: NIL

Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To educate students with fundamental concepts of Database Management System, Data Models, Different Data Base Languages.
2. To analyze Database design methodology.
3. To understand the basic principles, concepts and applications of data warehousing and data mining
4. To introduce the task of data mining as an important phase of knowledge recovery process
5. Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
6. Have a good knowledge of the fundamental concepts that provide the foundation of data mining

Topics Covered

UNIT-I **9L**

Introduction: An Overview of Database Management System, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure.

Data Modeling using Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.

UNIT-II **9L**

Relational Data Model and Language: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus.

Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views, and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete

Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

UNIT-III **9L**

Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling.

Distributed Database: Distributed Data Storage, Concurrency Control, Directory System. Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle

UNIT-IV **9L**

Data Mining & Warehousing: Introduction to Data Warehouse, Building A Data Warehouse, Data Warehouse Architecture, OLAP Technology, Introduction to Data Mining, Data Pre- Processing, Mining Association Rules, Classification and Prediction, Cluster Analysis, Advanced Techniques of Data Mining, and its applications.

Books & References

Textbooks

1. Korth, Silbertz, Sudarshan, Database Concepts, McGraw Hill
2. Jiawei Han, Micheline Kamber, Data Mining Concepts & Techniques, Elsevier
3. Elmasri, Navathe, Fundamentals of Database Systems, Addison Wesley

Reference books

1. Date C J, An Introduction to Database Systems, Addison Wesley
2. J. D. Ulman, Principles of Database and Knowledge base System, Computer Science Press.
3. M. H. Dunham, Data Mining: Introductory and Advanced Topics. Pearson Education
4. Mallach, Data Warehousing System, McGraw –Hill

BCS-37 NETWORK SECURITY & CRYPTOGRAPHY

Course category:	Program Elective (PE1)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes practical work, record, viva voce and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the basic concept of Cryptography and Network Security, their mathematical models
2. Various types of ciphers, DES, AES, message Authentication, digital Signature, System
3. Network security, Viruses, worms, and firewall
4. Understand mathematical foundation required for various cryptographic Algorithms.
5. DES, AES, IDEA and RC5 cryptographic technique
6. Public and Private Key cryptography.
7. Various Message Digest Algorithm,
8. Comprehend and apply email security services and mechanisms
9. Comprehend and apply IP security mechanisms
10. Comprehend and apply authentication services and mechanisms
11. Comprehend and apply WEB security mechanisms
12. Design of Firewall, Intrusion and Filtering

Topics Covered

UNIT-I **9L**

Introduction to Cryptography

Need, Attacks, Security Principles, Security Services, Conventional & Classical Encryption Techniques, Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, Differential & Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation

UNIT-II **9L**

Conventional Encryption Algorithm and Public Key Encryption

Triple DES, IDEA, RC5, AES, Key Distribution, Public Key Cryptography: Principles of Public Key Cryptosystem, RSA Algorithm, Key Management, Fermat's and Euler's Theorem, Chinese Remainder Theorem

UNIT-III **9L**

Hash Functions

Message Authentication and Hash Function: Authentication Requirements, Authentication Functions, Message Authentication Codes, Birthday Attacks, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signature, Authentication Protocol, Digital Signature Standard (DSS)

UNIT-IV **9L**

Network and System Security:

Authentication Applications: Kerberos, Electronic Mail Security, Pretty Good Privacy (PGP), S/MIME, IP Security: Authentication Header, Encapsulation Security Payload, Combining Security Association, Key Management, Web Security: Secure Socket Layer and Transport Layer security, Secure Electronic Transaction (SET), System security: Intruders, Viruses, Worms, Firewall design principles

EXPERIMENTS

1. Implementation of DES Algorithm.
2. Implementation of Random number generation.
3. Implementation of AES Cryptographic technique.
4. Implementation of IDEA Cryptographic technique.
5. Implementation of RSA Algorithm.
6. Generate the Digital signature.
7. Implementation of MD5 Algorithm.
8. Implementation of SHA Algorithm.
9. Implementation of MD5 Algorithm.
10. Demonstrate and implement the PGP Algorithm.
11. Demonstrate and simulate the working of Firewall

Books & References

Textbooks

1. William Stallings, Cryptography and Network Security Principles and Practices, Sixth Edition, PHI Publication
2. Atul Kahate, Cryptography and Network Security, Second Edition, TMH Publication
3. Shyamla, Harini and Padmnabhan, Cryptography and Security, Wiley Publication
4. Deven Shah, Information Security Principles and Practice, Wiley-India
5. Forouzan, Mukhopadhyay, Cryptography & Network Security, McGraw Hill

Reference books

1. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, John Wiley and Sons
2. Godbole, Information Systems Security, Wiley-India
3. Arto Salomaa, Public-Key Cryptography by, second edition, Springer, 1996
4. Goodrich and Tamassia, Introduction to Computer Security , Addison-Wesley Publication
5. Rubin, Geer and Ranum, Web Security Sourcebook: A Complete Guide to Web Security Threats and Solutions , Wiley Publication
6. Henk C.A. van Tilborg, An Introduction to Cryptology, Kluwer Academic Publishers
7. N. Doraswamy and Dan Harkins, IPSec- The New Security Standard for the Internet, Intranets, and Virtual Private Networks, Prentice Hall, USA

BEC-42 DIGITAL SIGNAL PROCESSING

Course category: Program Elective (PE1)

Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to analyze signals using the Discrete Fourier Transform and Fast Fourier Transform.
2. Able to understand the characteristics of infinite impulse response (IIR) filters and learn designing IIR filters for filtering undesired signals.
3. Able to understand the characteristics of finite impulse response (FIR) filters and learn designing FIR filters for filtering undesired signals.
4. Able to implement digital filters in a variety of forms: -Direct form I & II, Parallel, Cascade and lattice structure.

Topics Covered

UNIT-I **9L**

Discrete Fourier Transforms: Definitions, Properties of the DFT, Circular Convolution, Linear Convolution

Fast Fourier Transform Algorithms: Introduction, Decimation in Time (DIT) Algorithm, Computational Efficiency, Decimation in Frequency (DIF) Algorithm.

UNIT-II **9L**

IIR Filter Design: Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

UNIT-III **9L**

FIR Filter Design: Filter design using windowing (Rectangular Window, Hamming window, Hanning window, Blackman window, Kaiser window), Frequency sampling technique.

UNIT-IV **9L**

Realization of Discrete Time Systems: FIR systems – Direct form, cascaded, parallel and lattice structures**,** IIR systems – Direct form, cascaded, parallel, lattice and lattice ladder structures

Finite Word length Effects: Quantization effect in filter coefficients, round-off effect in digital Filters

Books & References

Textbooks

1. John G Prokias, Dimitris G Manolakis, "Digital Signal Processing", Pearson Education.
2. Oppenheim & Schafer, "Digital Signal Processing" PHI
3. Johnny R. Johnson, "Digital Signal Processing", PHI Learning Pvt Ltd.,2009.
4. S. Salivahanan, ""Digital Signal Processing" Mc Graw Hill Education

BEC-14 ELECTROMAGNETIC FIEL THEORY

Course category:	Program Elective (PE1)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, One Minor test, and One Major Theory.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Apply vector calculus to understand the behavior of Electrostatic Fields and Magnetostatic Fields in standard configurations.
2. Able to learn Maxwell's equations to understand boundary conditions of time varying fields.
3. Able to understand how EM waves will propagate in free space and their characteristics at the boundary between media
4. Become familiar with the characteristics of transmission lines and their equivalent circuits and learn parameters and transmission line equations. The Compensator design.

Topics Covered

UNIT-I **9L**

Electrostatics: Electrostatic fields, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses's Law – Maxwell's equation, Electric dipole and flux lines, Energy density in electrostatic fields. Electric field in material space: Properties of materials, Convection and conduction currents, conductors, Polarization in dielectrics, Dielectric Constants, continuity equation and relaxation time, Boundary condition. Electrostatic boundary value problems: Poisson's and Laplace's equations, General procedures for solving Poisson's or
Laplace's equations, Resistance and capacitance, Method of images.

UNIT-II **9L**

Magnetostatics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, Application of Ampere's law, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar, and vector potential. Magnetic forces, materials, and devices: Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole,
Magnetization in materials, magnetic boundary conditions, Inductors, and inductances, Magnetic energy. Waves and applications: Maxwell's equation, Faraday's Law, Transformer and motional electromotive forces, Displacement current, Maxwell's equations in differential and integral form.

UNIT-III **9L**

Electromagnetic wave propagation: Wave propagation in lossy dielectrics, Plane waves in lossless
dielectrics, Plane wave in free space, Plain waves in good conductors, Power and the Poynting vector, Reflection and Refraction of a plane wave at normal and Oblique incidence.

UNIT-IV **9L**

Transmission lines: Transmission line parameters, Transmission line equations, Input impedance, Standing wave ratio and power, The Smith chart, Coaxial lines and Waveguides.

Books & References

1. W. H. Hayt and J. A Buck "Electromagnetic field Theory" 7thEd.TMH
2. M. N. O. Sadiku, "Elements of Electromagnetics", 4th Ed, Oxford University Press

BEE-51 HIGH VOLTAGE ENGINEERING

Course category:	Program Elective (PE2)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts of break down in gases, solids & liquids with numerical calculation.

2. The concept of generation & measurement of high voltages & currents.
3. The concept of various high voltage testing.

Topics Covered

UNIT-I **9L**

Break Down in Gases:

Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, breakdown in vacuum.

Break Down in Solid & Liquid Dielectrics:

Classification of liquid dielectric, characteristic of liquid dielectric, breakdown in pure liquid and commercial liquid. Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric in practice, breakdown in composite dielectrics.

UNIT-II **9L**

Generation of High Voltages and Currents:

Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT-III **9L**

Measurement of High Voltages and Currents:

Measurement of high direct current voltages, measurement of high alternating and impulse voltages, measurement of high direct, alternating, and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

UNIT-IV **9L**

Non-Destructive Testing:

Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

High Voltage Testing:

Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Books & References

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.
2. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
3. M. P. Chaurasia, "High Voltage Engineering", Khanna Publishers
4. R. S. Jha, "High Voltage Engineering", Dhanpat Rai& sons
5. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
6. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.
7. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

BEE-52 INTELLIGENT INSTRUMENTATION

Course category:	Program Elective (PE2)
Pre-requisite Subject:	Instrumentation & Process Control (BEE-29)
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts of intelligent instrumentation system.
2. The concept of signal processing, manipulation & transmission.
3. The concept of Smart Sensors, Interfacing Instruments & Computers.
4. Recent trends in sensor technology.

Topics Covered

UNIT-I **9L**

Introduction:
Intelligence features characterizing intelligence, intelligent instrumentation system; features of intelligent instrumentation; components of intelligent instrumentation system; Block diagram of an intelligent instrumentation system.

UNIT-II **9L**

Signal Processing, Manipulation and Transmission:
Signal amplification & attenuation (OP-AMP based); Instrumentation Amplifier (circuit diagram, high CMRR & other features); Signal Linearization (different types such as Diode-resistor combination, OP-AMP based, etc.); Bias Removal, Signal filtering (outputs from ideal filters, outputs from constant-k filters, matching of filter sections active analog filters); OP-AMP based Voltage-to-current converter, Current-to-voltage conversion, Signal integration, Voltage follower (pre-amplifier), voltage comparator Phase locked loop, Signal addition, Signal multiplication, Signal Transmission (Signal amplification, Shielding, Current loop transmission, Voltage-to-frequency conversion, Fibre optic transmission).

UNIT-III **9L**

Smart Sensors, Interfacing Instruments & Computers:

Nonlinearity: took up table method, polygon interpolation, polynomial interpolation, cubic spline interpolation, Approximation & regression; Noise & interference; Response time; Drift; Cross-sensitivity; Basic issues of interfacing; Address decoding; Data transfer Control; A/D converter; D/A converter, Sample & hold circuit; Other interface considerations.

UNIT-IV **9L**

Recent Trends in Sensor Technologies:

Introduction; Film sensors (Thick film sensors, thin film sensors); Semiconductor IC technology-standard methods; microelectro-mechanical systems (Micro-machining, some application examples); Nano-sensors.

Books & References

1. Barney, G.C. Intelligent Instruments. Hemel Hempstead: Prentice Hall, 1985.
2. Alan S. Morris, Principles of Measurement& instrumentation. N. Delhi; PHI Pvt. Ltd., 1999.
3. D. Patranabis, Sensors & Transducers N. Delhi: 2003.
4. Roman Kuo, Introduction to Digital Signal Processing. N. York: McGraw-Hill Pub, Co.

BEE-53 DIGITAL CONTROL SYSTEM

Course category:	Program Elective (PE2)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts of Signal Processing in Digital Control.
2. The concept of Time Domain and Frequency Domain Analysis.
3. The concept of State Space Analysis and Design.
4. Stability of Discrete System.

Topics Covered

UNIT-I **9L**

Signal Processing in Digital Control:

Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modelling of sample-hold circuit, pulse transfer function, solution of difference equation by z-transform method.

UNIT-II **9L**

Time Domain and Frequency Domain Analysis:
Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

UNIT-III **9L**

State Space Analysis and Design:
State space representation of digital control system, conversion of state variable models to transfer functions and vice-versa, solution of state difference equations, controllability and observability, design of digital control system with state feedback.

UNIT-IV **9L**

Stability of Discrete System:
Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on r^{th} plane.

Books & References

1. K. Ogata, "Discrete-Time Control System", Pearson Education.
2. B.C. Kuo, "Digital Control System", Saunders College Publishing.
3. M. Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill.

BEE-54 CONVENTIONAL AND CAD OF ELECTRICAL MACHINES

Course category:	Program Elective (PE2)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts of transformer design.

2. The concept of 3-phase synchronous machines, IM & computer aided design.

Topics Covered

UNIT-I **9L**

Basic Considerations:
Basic concept of design, limitations in design, standardization, modern trends in design and manufacturing techniques, Classification of insulating materials. Heating and Cooling of electrical machines. Transformer Design: Output equation design of core, yoke and windings, overall dimensions, Computation of no-load current, voltage regulation, efficiency, and cooling system designs

UNIT-II **9L**

Design of 3-phase synchronous machines:
Output equation, specific electric and magnetic loadings, factors affecting size of machines, separation of main dimensions, Stator design, losses in stator, damper winding design, rotor design of salient pole synchronous machines, determination of OCC by design data, stator leakage reactance, rotor design of cylindrical machines

UNIT-III **9L**

Design of 3-phase induction machines:
Output equation, specific electric and magnetic loadings, factors affecting size of machines, separation of main dimensions, Stator design, losses in stator, Rotor design, concept of flattened flux density, no load current, Estimation of performance, construction of circle diagram from design data, stator temperature rise.

UNIT-IV **9L**

Computer Aided Design:
Philosophy of computer aided design, advantages, and limitations. Computer aided design approaches analysis, synthesis, and hybrid methods. Concept of optimization and its general procedure. Flow charts and 'c' based computer programs for the design of transformer, dc machine, three phase induction and synchronous machines. Core and armature design of dc machines, design of field system of dc machine

Experiments

CAD LAB

1. CAD of 3-phase Synchronous Machines: Design of Core, Yoke, dimensions etc.
2. CAD of 3-phase Induction Motors: Design of main dimensions, Yoke dimensions etc.
3. CAD of Transformer: Design of Core, Yoke, dimensions etc.

Books & References

Textbooks:

1. K. Sawhney, "A Course in Electrical Machine Design," Dhanpat Rai & Sons.
2. K.G. Upadhyay, "Design of Electrical Machines" New Age International Publishers, New Delhi.

Reference Books:

3. M.G. Say, "The Performance and Design of AC Machines" Pitman & Sons.
4. A.E. Clayton and N.N. Hancock, "The Performance and Design of D.C. Machines" Pitman & Sons.
5. S.K. Sen, "Principle of Electrical Machine Design with Computer Programming" Oxford and IBM Publications.

BCS-44/BCS-13 OBJECT ORIENTED TECHNIQUES & JAVA PROGRAMMING

Course category:	Program Elective (PE3)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Knowledge of how to develop and deploy applications and applets in JAVA.
2. Knowledge of how to develop and deploy GUI using JAVA Swing and AWT.
3. Design, develop and implement interactive web applications.
4. Be able to implement, compile, test and run JAVA programs comprising more than one class and to address a particular software problem.
5. Develop programs using the JAVA Collection API as well as the JAVA standard class library.

Topics Covered

UNIT-I **9L**

Introduction: Introduction to Programming Languages, The Evolution of JAVA, Object-Oriented Programming Concepts and JAVA, Differences between C++ and JAVA, Primary

Characteristics of JAVA, The Architecture, Programming with JAVA, Operator, Data type, Variable, Arrays, Control Statements, Methods.

UNIT-II **9L**

Core JAVA: Classes, Inheritance, Package and Interface, Exception Handling, Multithread Programming, I/O, JAVA Applet, String Handling, Networking, Event Handling, Introduction to AWT, AWT Controls, Layout Managers.

UNIT-III **9L**

JAVA Swing: Creating a Swing Applet and Application, Programming using Panes, Pluggable Look and Feel, Labels, Text Fields, Buttons, Tabbed Panes.

UNIT-IV **9L**

JDBC: Connectivity Model, JDBC/ODBC Bridge, JAVA.SQL Package, Connectivity to Remote Database, JAVA Beans: Application Builder Tools, The Bean Developer Kit (BDK), JAR files, Introspection, developing a Simple Bean, Servlet: Introduction to JAVA Servlet: Servlet Basics, Servlet API Basic, Life Cycle of a Servlet, Running Servlet.

Books & References

Textbooks

1. Balaguruswamy E, Programming in JAVA, TMH Publication

Reference books

2. Dustin R. Callway, Inside Servlets, Addison Wesley.
3. Mark Wutica, JAVA Enterprise Edition, QUE.
4. Steven Holzner, JAVA2 Black book, Dreamtech.

BEC-28 PRINCIPLES OF COMMUNICATION

Course category:	Program Elective (PE3)
Pre-requisite Subject:	Signals & Systems (BEC-13)
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, viva voce and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to understand the basic concept of analog communication system and analyze the various amplitude modulation schemes.
2. Able to distinguish angle modulation with amplitude modulation and analyze various modulation/demodulation techniques of angle modulation.
3. Able to classify the types of noise sources added in communication channel and analyse its performance in analog communication system.
4. Able to describe and analyse the various pulse modulation and multiplexing techniques for the digital transmission of analog signal.

Topics Covered

UNIT-I **9L**

Amplitude Modulation: Overview of Communication system, Communication channels, Need for modulation, Baseband and Pass band signals, Comparison of various AM systems
Amplitude Modulation: Double sideband with Carrier (DSB-C), Double sideband without Carrier, Single Side-band Modulation, SSB Modulators and Demodulators, Vestigial Side-band (VSB), Quadrature Amplitude Modulator.

UNIT-II **9L**

Introduction to Angle Modulation: Frequency modulation, Narrowband and Wideband FM, Generation of FM waves, Indirect FM and direct FM, FM modulators and demodulators, Phase locked loop, Angle Modulation by Arbitrary Message Signal, Phase Modulation, Pre-emphasis, and De-emphasis, Linear and Nonlinear Modulation, Comparison between Angle Modulation and Amplitude Modulation, Radio Receivers.

UNIT-III **9L**

Noise: Source of Noise, Frequency domain, Representation of noise, Linear Filtering of noise, Noise in Amplitude modulation system, Noise in SSB-SC, DSB and DSB-C, Noise Ratio, Noise Comparison of FM and AM, Pre-emphasis and De-emphasis, Figure of Merit

UNIT-IV **9L**

Pulse Modulation and Digital Transmission of Analog Signal: Sampling Theorem and its applications, Concept of Pulse Amplitude Modulation, Pulse width modulation and pulse position modulation, PCM, Pulse Time Modulation, TDM and FDM. Line Coding, Quantizer, Quantization Noise, Compounding multiplexer.

EXPERIMENTS

A. Compulsory Experiment:

1. To study Amplitude modulation using a transistor and determine depth of modulation.
2. To study envelope detector for Demodulation of AM signal and observe diagonal clipping.
3. To study frequency modulation using reactance modulator.
4. Narrow band FM generation using varactor modulator.
5. Generation of DSB-SC signal using balance modulator.
6. Generation of single side band signal.
7. Study of PLL and detection of FM signal using PLL.

B. Optional Experiments:

8. To study and implement Pre-emphasis and De-emphasis circuits.
9. To design and test the circuits of voltage to frequency converter usingIC-555.
10. To understand and implement Pulse Amplitude Modulation (PAM) usingIC-555.
11. To understand and implement Pulse Width Modulation (PWM) usingIC-555.
12. To understand and implement Pulse Position Modulation (PAM) usingIC-555.

Books & References

1. H. Taub, D L Schilling, Goutom Saha, "Principles of Communication", 3e, Tata McGraw-Hill Publishing Company Ltd.
2. B.P. Lathi, "Modern Digital and Analog communication Systems", 3e, Oxford University Press,2009.
3. Simon Haykin, "Communication Systems",4e, Wiley India.
4. H. P. HSU & D. Mitra, "Analog and Digital Communications", 2e, Tata McGraw-Hill Publishing Company Ltd.

BEE-55 EHV AC & DC TRANSMISSION

Course category:	Program Elective (PE3)
Pre-requisite Subject:	Power System-I & II
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The basic concepts of EHV & DC transmission.
2. The concept of Extra High Voltage Generation, Measurement and Testing.
3. The concept of HVDC transmission

Topics Covered

UNIT-I **9L**

Introduction: Need of EHV transmission, standard transmission voltage, comparison of EHV ac & dc transmission systems and their applications & limitations, mechanical design considerations of transmission lines, modern trends in EHV AC and DC transmission systems

UNIT-II **9L**

EHV AC Transmission: Corona effects, Corona loss formulas, audible noise – generation and characteristics, corona Pulses, generation and properties, radio interference, over voltages in EHV system caused by switching operations, Concept of travelling waves and standing waves

UNIT-III **9L**

Extra High Voltage Generation, Measurement and Testing: Characteristics and generation of impulse voltage, Impulse current, generation of high AC and DC voltages, measurement of high voltages, general lay out of EHV Labs, Standard testing methods, EHV line insulation testing characteristics, protection of EHV lines.

UNIT-IV **9L**

HVDC Transmission: Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters. Principle of dc link control, converter controls characteristics, firing angle control, excitation angle control, Converter faults, generation of harmonics, ac and dc filters, Multi Terminal DC systems (MTDC): Types, control, protection and applications.

Books & References

1. R. D. Begamudre, “Extra High Voltage AC Transmission Engineering” Wiley Eastern.
2. K. R. Padiyar, “HVDC Power Transmission Systems: Technology and System Reactions”
3. New Age International.
4. J. Arrillaga, “High Voltage Direct Current Transmission” IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London.
5. M. S. Naidu & V. Kamaraju, "High Voltage Engineering” Tata McGraw Hill.
6. M. H. Rashid, “Power Electronics: Circuits, Devices and Applications" Prentice Hall of India.

7. S. Rao, "EHV AC and HVDC Transmission Engineering and Practice" Khanna Publisher.
8. "EPRI, Transmission Line Reference Book, 345 KV and above" Electric Power Research Institute. Palo Alto, California, 1982.

BEE-56 ADVANCED MICROPROCESSOR AND MICROCONTROLLERS

Course category:	Program Elective (PE3)
Pre-requisite Subject:	Introduction to Microprocessors
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Its Architecture & assembly languages.
2. Interfacing & Coprocessor 8087.
3. The concept of Micro-controller.
4. High end processor.

Topics Covered

UNIT-I **9L**

Introduction to Architecture of Microprocessors: General definitions of minicomputers, microprocessors, micro controllers and digital signal processors. Overview of 8085 microprocessor. Overview of 8086 microprocessor. Signals and pins of 8086 microprocessor. Assembly language of 8086: Description of Instructions. Assembly directives. Assembly software programs with algorithms.

UNIT-II **9L**

Interfacing with 8086: Interfacing with RAMS, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8259 etc. Interfacing with keyboards, LEDs, LCDs, ADCs, and DACs etc.

UNIT-III **9L**

Introduction to Micro controllers: Overview of the architecture of 8051 microcontroller. Overview of the architecture of 8096, 16-bit microcontroller. Assembly language of 8051: Description of Instructions. Assembly directives. Assembly software programs with Algorithms. Interfacing with 8051: Interfacing with keyboards, LEDs, *7* segment LEDs, LCDs, Interfacing with ADCs. Interfacing with DACs, etc.

UNIT-IV **9L**

High end processors: Introduction to 80386, 80486 and Pentium Processors.

EXPERIMENTS

1. Description of 8086 Pin Diagram.
2. Study of 8086 Instruction Set

- **8086 Programs**

3. 16-bit addition using 8086 microprocessors
4. Move contents of array
5. Sum of 'n' consecutive numbers
6. Conversion of BCD number to decimal
7. Separating Odd and Even numbers
8. Description of 8051 Pin Diagram
9. Study of8051 Instruction Set

- **8051 Programs**

10. Addition of 8-bit numbers using 8051
11. Subtraction of 8-bit numbers using 8051

Books & References

1. Ramesh S. Gaonkar "Microprocessor Architecture, Programming, and Applications with the 8085", Prentice Hall PTR, 2002.
2. A.K. Ray & K. M. Bhurchandi, "Advanced microprocessors and Peripherals", Tata McGraw Hill.
3. James L. Antonakos, "An Introduction to the Intel family of Microprocessors" Pearson Education 1999.
4. Barry.B.Breg," The Intel Microprocessors Architecture, Programming and Interfacing, PHI, 2002.
5. James L. Antonakos, "The Pentium Microprocessor," Pearson Education, 1997".

BEE-57 MODERN CONTROL SYSTEM

Course category:	Program Elective (PE4)
Pre-requisite Subject:	Control System Engineering (BEE-28)
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4

Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concept of control system design, state space analysis & state space control design.
2. The concept of Non-Linear System.

Topics Covered

UNIT-I **9L**

Introduction to Control Design:
Introduction, review of conventional control design techniques, continuous-time and discrete-time system modelling, time response analysis, and frequency response analysis; control design problem and preliminary considerations; lead, lag and lead-lag networks, compensator design using root locus plots and frequency response plots.

UNIT-II **9L**

State Space Analysis:
State variable representation, state variable model, conversion of state variable models to transfer function and vice-versa, solution of state equations, state transition matrix, controllability, and observability.

UNIT-III **9L**

State Space Control Design:
Design of state observer and controller. Pole-placement technique, Ackerman formula, observer-controller design.
Stability Analysis: Continuous-time and discrete-time systems stability analysis, Lyapunov's stability theorems.

UNIT-IV **9L**

Nonlinear System:
Types of nonlinearities, nonlinear systems analysis, linearization method, system analysis by phase-plane method, describing function and their applications Three Phase Induction Motor: Types, Principle of operation, Torque-slip characteristics, Applications.

Books & References

1. I. J. Nagrath and M. Gopal, "Control System Engineering", 4th Edition, New age International.
2. K. Ogata, "Modern Control Engineering", Pearson Education, 4th Indian reprint.
3. D. Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.
4. Ajit K. Mandal, "Introduction to Control Engineering" New Age International, 2006.

BEE-58 SCADA AND ENGINEERING MANAGEMENT SYSTEM

Course category:	Program Elective (PE4)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts of SCADA & its use in power system.
2. The concept of energy management system.
3. SCADA System Components and Applications.

Topics Covered

UNIT-I **9L**

An Introduction to SCADA:
Purpose and necessity, general structure, data acquisition, transmission & monitoring, general power system hierarchical Structure. Overview of the methods of data acquisition systems, transducers, RTUs, Master terminal unit, various communication channels- cables, telephone lines, power line, microwaves, optical fiber channels and satellites.

UNIT-II **9L**

SCADA in Power System:
Tasks in power system operation, Operational tasks at various hierarchical levels, National load control centre, regional load control centre, generating station control management, SCADA types, Automatic generation control, SCADA in power distribution, SCADA in power grid, distribution substation and feeder automation

UNIT-III **9L**

Supervisory Power Management:

Energy Management system, power system operational states, security analysis, state estimation, load forecasting, classification of load forecast, effecting factors, methods of load forecasting, energy audit, utility distributed system design, regulation and distribution automation, fault control management.

UNIT-IV **9L**

SCADA System Components and Applications:
Intelligent electronic device, SCADA server, Human-Machine interface, Components of control system, Programmable logic controllers, SCADA applications in various utilities, SCADA applications for transmission and distribution sector, SCADA base Instrumentation, Case studies on SCADA.

Books & References

1. Torsten Cergrell, " Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall of India,
3. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
4. T.K Bisht, “SCADA and Energy Management System” S K Kataria and sons

BEE-59 ENERGY EFFICIENCY & CONSERVATION

Course category:	Program Elective (PE4)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. The concepts of Energy conservation& Energy Audit.
2. The concept of Demand Side Management, Voltage and Reactive power in Distribution System.
3. The concept of Efficiency in Motors and Lighting system.

Topics Covered

UNIT-I **9L**

Energy conservation:
Principles of Energy Conservation, Energy conservation Planning, Energy conservation in small scale industries, large scale industries and in electrical generation, transmission, and distribution. Energy conservation Legislation.

Energy Audit: -
Aim of energy Audit, Strategy of Energy Audit, Energy management Team Considerations in implementing energy conservation Programme, Instruments for energy audit, Energy audit of Electrical System, HVAC, Buildings, Economic analysis.

UNIT-II **9L**

Demand Side Management:
Concept and Scope of Demand Side Management, Evolution of Demand Side DSM Strategy, Planning, Implementation, and its application. Customer Acceptance & its implementation issues. National and International Experiences with DSM. 8

UNIT-III **9L**

Voltage and Reactive power in Distribution System:
Voltage and reactive power calculations and control: Voltage classes and nomenclature, voltage drop calculations, Voltage control, VAR requirements and power factor, Capacitors unit and bank rating, Protection of capacitors and switching, Controls for switched capacitors and fields testing.

UNIT-IV **9L**
Efficiency in Motors and Lighting system:
Load scheduling/shifting, Motor drives- motor efficiency testing, energy efficient motors, and motor speed control. Lighting- lighting levels, efficient options, fixtures, day lighting, timers, Energy efficient windows. UPS selection, Installation operation and maintenance. Indian Electricity Act 1956, Distribution Code and Electricity Bill 2003

Books & References

1. Tripathy S. C., "Electric Energy Utilization and conservation", Tata McGraw Hill.
2. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982.
3. "The Efficient Use of Energy", Edited by I. G. C. Dryden, Butterworths, London, 1982.
4. Energy Management Handbook, Edited by W. C. Turner, Wiley, New York, 1982.
5. L. C. Witte, "P. S. Schmidt, D.R. Brown, Industrial Energy Management and Utilization", Hemisphere Publ, Washington, 1988
6. Power Capacitor Handbook, Butterworth & Co (Publishers) Ltd, 1984.
7. Electrical Systems Analysis and Design for Industrial Plants, McGraw-Hill Book Company.
8. IEEE Bronze Book, 'Recommended Practice for Energy Conservation and cost-effective planning in Industrial facilities, IEEE Press.

BEE-60 BIO INSTRUMENTATION

Course category:	Program Elective (PE4)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

6. The Fundamentals of Bio-Medical Instrumentation.
7. The concept of the Cardiovascular System and Measurements.
8. The concept of the Nervous & Respiratory System and its Measurements.
9. Patient Care Monitoring & Imaging Techniques.

Topics Covered

UNIT-I **9L**

Fundamentals of Bio-Medical Instrumentation:
Introduction to bio-instrumentation, anatomy & physiology, basic medical instrumentation scheme, different physiological systems of body, Problems encountered in measuring living systems, Transducers for biomedical applications. Generation, propagation, and distribution of different bioelectric potentials (ECG, EEG, EMG etc.). Bio-potentials electrodes, electrode theory, types of electrodes, biochemical transducers. Action& resting potentials.

UNIT-II **9L**

The Cardiovascular System and Measurements:
The heart, electrical &mechanical activity, cardiovascular systems, Electrocardiography, ECG lead configurations ECG recording and their types, Einthoven triangle, interferences. Measurement methods of blood flow, heart sound, Phonocardiogram, circulation block diagram of blood pressure and measurement.

UNIT-III **9L**

The Nervous & Respiratory System and its Measurements

The anatomy of nervous system, Neuronal communication, EPSP & IPSP, Organization of the brain, Measurements from the nervous system, Respiratory system, Different types of Spirometers, Body & skin temperature measurements.

UNIT-IV **9L**

Patient Care Monitoring & Imaging Techniques:
Elements of intensive care, Organization of the Hospital (HIS) for patient-care monitoring, Pace-makers-types, modes and generators, Defibrillators-types. Instrumentation for diagnostic; X Rays, Ultrasonic, CT & MRI, biomedical computer applications. Shock hazards from electrical equipment, methods of accident prevention.

Books & References

1. T. Cromwell, F.J. Weibell&F.A.Pfieffer, "Biomedical Instrumentation & Measurements" Prentice Hall International
2. R.S. Khanpur, "Handbook of Biomedical Instrumentation" Tata McGraw Hill
3. H.E. Thomas, "Handbook of Biomedical Instrumentation and Measurement" Restone Publishing Company
4. J.G. Webester, "Medical Instrumentation", Houghton Mifflin.

Audit Courses for B. Tech. (Electrical Engineering)

BPM-03/BAS-06 SPACE SCIENCE

Course category:	Audit Course
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Breadth and depth of knowledge in Space Science subject.
2. Students will find a useful place for applying their engineering knowledge and skills in the domain of Space Science and broadly saying astrophysics.
3. Group learning and problem solving.

4. The tools and techniques which can help them to peep into the Universe and fiddle the riddles there in.

Topics Covered

UNIT-I **6L**

Observational Astronomy: Introduction ancient age astronomy and the scientific revolution of Copernicus and Galileo, Astronomical techniques: Telescope, its construction, functioning, resolving and its light gathering power, Use of balloon for observations on earth, Requirement of rocket and satellite technology, Charge Couple Device (CCD) as an optical detection system, An overview of Radio, infrared, microwave, ultra-violet, X-rays & γ –rays telescope with specific examples and their pioneering breakthroughs, An overview of near earth and space explorations using satellite, robotic and manned missions, Gravitational redshift by sun, clock rates in satellites, Gravitational lensing, Perihelion motion of mercury, Importance of observational astronomy and telecommunication.

UNIT-II **6L**

Our Solar System: Origin of our solar system, Sun and its theoretical model, Energy production inside stars: proton-proton chain & CNO cycle, Sun's chromosphere, Solar storm and the solar wind, Neutrinos from Sun, The description of eight planets and their moons with their atmospheric and geographical conditions & vital statistics, Removal of Pluto from the list of nine planets, Classification of planets, The green-house effect, Existence in favor water in remote past of mars, Other planetary bodies: Asteroids, comets and meteorites, The cosmic dust, Oort cloud and the Kuiper's belt, The great comet crash: Shoemaker-Levy, Types of asteroids and their properties, The direct and indirect spectroscopy.
Titus-Bode law, Keplar's laws of planetary motion, Newton's law of gravitation from Keplar's law of planetary motion

UNIT-III **6L**

(a) **Stars and their classification:** Harvard classification of stars, Morgan-Keenan system, spectral classification of stars, The Hertzsprung-Russel diagram: main sequence stars, red and super-red giants, dwarf stars and black holes, Sun's evolution in H-R diagram, The Schwarzchild solution: massive stars, singularity and the black holes, Loss of information from a black hole, Accretion of mass and emission of jets in a binary star system: neutron star, black hole, Theory of compact stars: White dwarf stars and neutron stars; their evolution and equilibrium.

(b) **Large celestial bodies:** Our galaxy, Types of galaxies: Elliptical, Spiral and SO type of galaxies, Irregular galaxies, their morphology, evolution and contents, Hubble's tuning fork diagram, Cluster of galaxies and their evolution, Collision and merger of galaxies, Active galaxies: Exploding galaxies, Seyfert galaxies, Quasars and pulsars etc.

UNIT-IV **6L**

The Big-Bang Theory: The expanding universe: Hubble's law and constant, The flaw in Hubble's measurement, The hot big-bang model: arguments in its favour and against, The evolution of the universe after big-bang: description of different phases, matter, energy and forces, Models of the Universe: the closed, open and flat models and their relevance with observations, Origin of various bands of electromagnetic bands of spectrum in Universe, COBE: black body spectrum of the Universe, The existence of dark matter and dark energy: composition, Role of dark matter and dark energy in evolution of Universe, Cosmic rays, Creation of mass and the God particle.

Books & References

1. Introduction to Cosmology- J. V. Narlikar, Cambridge University Press
2. Introduction to Special Relativity and Space Science - Satya Pal Singh, Wiley India Pvt. Ltd., New Delhi
3. Observational Astronomy - D. Scott Birney, Guillermo Gonzalez and David Oesper, Cambridge University Press.
4. Observational Astronomy: Technique and Instrumentation - Edmund C Sutton, Cambridge University Press

100 billion Suns: The Birth, Life and Death of Stars - Kippenhahn R, Weidenfeld and Nicolson

BCS-01 INTRODUCTION TO C PROGRAMMING

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory & Practical Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Read and understand C programs.
2. Discuss basic theory and practice of programming.
3. Design and implement practical programs using C language.
4. Use compiler and feel comfortable with Windows environment

5. Identify and fix common C errors

Topics Covered

UNIT-I **9L**

Basics of Computer: Introduction to Digital Computer, Basic Operations of Computer, Functional Components of Computer, Classification of Computers. Introduction to Operating System: DOS, Windows, Linux, Function, Services and Types. Basics of Programming: Approaches to Problem Solving, Concept of Algorithm and Flow Charts, Types of Computer Languages: Machine Language, Assembly Language and High-Level Language, Concept of Assembler, Compiler, Loader and Linker.

UNIT-II **9L**

Standard I/O in "C", Fundamental Data Types and Storage Classes: Character Types, Integer, Short, Long, Unsigned, Single and Double-Precision Floating Point, Storage Classes, Automatic, Register, Static and External, Operators and Expressions: Using Numeric and Relational Operators, Mixed Operands and Type Conversion, Logical Operators, Bit Operations, Operator Precedence and Associativity, C Conditional Program Execution: Applying if and Switch Statements, Nesting if and else, Restrictions on switch Values, Use of Break, Program Loops and Iteration: Uses of while, do and for Loops, Multiple Loop Variables, Assignment Operators, Using Break and Continue.

UNIT-III **9L**

Arrays: One Dimensional, Multidimensional Array and their Applications, Declaration and Manipulation of Arrays Structures: Purpose and Usage of Structures, Declaring Structures, Assigning of Structures, Strings: String Variable, String Handling Functions, Array of Strings, Functions: Designing Structured Programs, Functions in C, User Defined and Standard Functions, Formal vs. Actual Arguments, Function Category, Function Prototype, Parameter Passing, Recursive Functions. Storage Classes: Auto, Extern, Register and Static Variables.

UNIT-IV **9L**

Pointers: Pointer Variable and its Importance, Pointer Arithmetic and Scale Factor, Compatibility, Dereferencing, L value and R-Value, Pointers and Arrays, Pointer and Character Strings, Pointers and Functions, Array of Pointers, Pointers to Pointers Dynamic Memory Allocation Structure and Union: Declaration and Initialization of Structures, Structure as Function Parameters, Structure Pointers, Unions. File Management: Defining and Opening A File, Closing A File, Input/Output Operations in Files, Pre-Processor Directives, Command Line Arguments.

EXPERIMENTS

1. Write a program that finds whether a given number is even or odd.
2. Write a program that tells whether a given year is a leap year or not.
3. Write a program that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
    a. Between 90-100% ------- Print „A"
    b. Between 80-90% --------- Print „B"
    c. Between 60-80% --------- Print „C"
    d. Below 60% ---------- Print ,,D"
4. Write a program that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
5. Write a program to print sum of even and odd numbers from 1 to N numbers.
6. Write a program to print the Fibonacci series.
7. Write a program to check whether the entered number is prime or not.
8. Write a program to find the reverse of a number.
9. Write a program to print Armstrong Numbers from 1 to 100.
10. Write a program to convert binary number into decimal number and vice versa.
11. Write a program that simply takes elements of the array from the user and finds the sum of these elements.
12. Write a program that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
13. Write a program to find the minimum and maximum element of the array.
14. Write a program to search an element in array using Linear Search.
15. Write a program to sort the elements of the array in ascending order using Bubble Sort technique.
16. Write a program to add and multiply two matrices of order NxN.
17. Write a program that finds the sum of diagonal elements of a MxN matrix.
18. Define a structure data type TRAIN_INFO. The type contain
    a. Train No.: integer type
    b. Train name: string
    c. Departure Time: aggregate type TIME
    d. Arrival Time: aggregate type TIME
    e. Start station: string
    f. End station: string

    The structure type Time contains two integer members: hour and minute. Maintain a train Timetable and
19. implement the following operations:
    i. List all the trains (sorted according to train number) that depart from a particular section.
    ii. List all the trains that depart from a particular station at a particular time.
    iii. List all he trains that depart from a particular station within the next one hour of a given time.

iv. List all the trains between a pair of start station and end station.

20. Write a program to swap two elements using the concept of pointers.
21. Write a program to compare the contents of two files and determine whether they are same or not.

Books & References

1. Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, 7th edition, Pearson.
2. Childt, Herbert Complete reference with C Tata McGraw Hill
3. Kerninghan and Ritchie, The C programming language, Prentice Hall
4. Samuel P. Harbison, and Guy L. Steele Jr., C-A Reference Manual, Fifth Edition, Prentice Hall, 2002

BCY-04/BAS-05 Environment & Ecology

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Environment and Ecology, which allows students to gain qualitative and quantitative skills.
2. Students will be aware of environmental pollution and control methods along with quality standards of air, water etc. along with waste management.
3. Students will be able to give systematic account of natural resources their use of exploitation and environmental.
4. How to achieve sustainable development through strategies and its threats.

Topics Covered

UNIT-I **6L**

The Multidisciplinary nature of environmental studies, Definition, scope, and importance, Need for public awareness. Natural Resources, Renewable and non-renewable resources, Natural resources, and associated problems

a. Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining.
b. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits, and problems.
c. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources,
d. Food resources: World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
e. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

UNIT-II **6L**

Ecosystems
Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure, and function of the following ecosystem: (a) Forest ecosystem (b) Grassland Ecosystem (c) Aquatic ecosystems (ponds, rivers, oceans)

Biodiversity
Introduction- Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National, and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, Endangered and endemic species of India,

Conservation of biodiversity:

UNIT-III **6L**

Environmental Pollution Causes, effects, and control measures of-

(a) Air Pollution. (b) Water Pollution. (c) Soil Pollution (d) Marine Pollution. (e) Noise Pollution. (f) Thermal Pollution.

Solid waste Management: Causes, effects, and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Global warming and greenhouse effect, Acid Rain, Ozone Layer depletion

UNIT-IV **6L**

Environmental Protection- Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), 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.
Human Population and the Environment
Population growth, Population explosion- Family Welfare Programme, Environment and human health, Environmental Education, Women Education., Women and Child Welfare

Books & References

1. Environmental Studies - J Krishnawamy, R J Ranjit Daniels, Wiley India
2. Environmental Science - Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall
3. Environment and Ecology - R K Khandal, 978-81-265-4277-2, Wiley India
4. Environmental Science – 8th edition ISV, Botkin and Keller, 9788126534142, Wiley India
5. Environmental Studies - Soli. J Arceivala, Shyam, R Asolekar, McGraw Hill India, 2012
6. Environmental Studies - D.L. Manjunath, 9788131709122 Pearson Education India, 2007

BPM-04/BAS-22 NANOTECHNOLOGY

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Will be able to demonstrate breadth and depth of knowledge in nanoscience and nanotechnology.
2. The effect of dimensionality and size on material properties.
3. The tools and techniques which can help them to experimentally observe nanomaterials.
4. They can explore the material world with their advance possible applications in making devices and sophisticated instruments.
5. They can find the vital role of this emerging area across various engineering

disciplines.

Topics Covered

UNIT-I **6L**

Introduction

Definition of Nanoscience and Nanotechnology, Applications of Nanotechnology.

Introduction to Physics of Solid State

Structure: Size dependence of properties; crystal structures, Face Centered Cubic (FCC) and Hexagonal Closed Packing (HCP) nanoparticles; Tetrahedrally bounded semiconductor structures; lattice vibrations.

Energy Bands

Insulators, semiconductor, and conductors; Reciprocal space; Energy bands and gaps of semiconductors

UNIT-II **6L**

Quantum Theory for Nanoscience

Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step, Overview of Reflection and tunneling, Penetration of Barrier, Electron trapped in 2D plane sheet, Quantum confinement effect in nanomaterials.

Quantum Wells, Wires and Dots

Preparation of Quantum Nanostructure; Size and Dimensionality effect.

UNIT-III **6L**

Growth Techniques of Nanomaterials

Lithographic and Non-lithographic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique. Thermal evaporation technique, E-beam evaporation, Chemical Vapour Deposition (CVD), Pulsed Laser Deposition, Molecular beam Epitaxy, Sol-Gel Technique (No chemistry required), Electro-deposition, Chemical bath deposition, Ion beam deposition system.

Some Important Nanostructures

Bucky Ball, Carbon nanotubes, synthesis, properties, and their applications.

UNIT-IV **6L**

Tools for Characterization of Nanomaterials

Structure: Crystallography, particle size determination, surface structure.

Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM).

Books & References

1. Introduction to Nanotechnology - C.P. Poole Jr and F.J. Owens, Wiley India, New Delhi

2. Nano Materials - A.K. Bandyopadhyay, New Age International
3. Microcluster Physics - S. Sugano & H. Koizuoni, Springor 1998
4. Handbook of Nanostructured Materials & Nanotechnology" vol.-5, Academic Press, 2000

BCS-33 WEB TECHNOLOGIES

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Identify common design mistakes when creating a web-based application.
2. Discuss the process of editing a web page using text editors and web page editors
3. Cover commonly used HTML tags and discuss how this knowledge is important to a web designer.
4. Demonstrate an understanding of basic CSS, XML, JAVA Script, JSP, ASP.NET and PHP

Topics Covered

UNIT-I **9L**

Introduction to WWW- World Wide Web, WWW Architecture, Web Search Engines, Web Crawling, Web Indexing, Web Searching, Search Engines Optimization and Limitations, Web Mining: Web Content Mining, Web Structure Mining, Web Usage Mining

UNIT-II **9L**

Markup Language Basics: SGML, HTML, CSS And XML

SGML: Standard Generalized Markup Language (SGML) -Structures, Elements, Content Models, DTD, Attributes Entities.

HTML: Designing Web Pages With HTML-Use of Tags, Hyperlinks, URLs, Tables, Text Formatting, Graphics & Multimedia, Imagemap, Frames and Forms in Web Pages.

CSS: Use of Cascading Style Sheet in Web Pages.

XML: Extensible Markup Language (XML): Introduction using User-Defined Tags in Web Pages, Displaying XML Contents, XML Dtds, Use of XSL

UNIT-III **9L**

Client-Side Scripting using JAVA Script

JAVA script Overview; Constants, Variables, Operators, Expressions & Statements; User-Defined & Built-in Functions; Client-Side Form Validation; Using Properties and Methods of
Built-in Objects

UNIT-IV **9L**

Server-Side Scripting Using JSP, **ASP.NET And PHP**

JSP: Introduction to JSP, JSP Architecture, JSP Directives, JSP Scripting Elements, Default Objects in JSP, JSP Actions, JSP with Beans and JSP with Database, Error Handling in JSP, Session Tracking Techniques in JSP, Introduction to Custom Tags.

ASP.NET: ASP.Net Coding Modules, ASP.NET Page Directives, Page Events and Page Life Cycle , Postback and Crosspage Posting ASP.NET Server Controls , HTML Controls, Validation Controls, Building Databases .

PHP (Hypertext Preprocessor)-Introduction, Syntax, Variables, Strings, Operators, If- Else, Loop, Switch, Array, Function, Form ,Mail, File Upload, Session, Error, Exception, Filter, PHP- ODBC

EXPERIMENTS

1. Create a HTML static web page which shows the use of different tags in that.
2. Insert an image and create a link such that clicking on image takes user to other page.
3. Prepare a sample code to illustrate three types of lists in HTML.
4. Use tables to provide layout to your HTML page describing your university infrastructure
5. Use frames such that page is divided into 3 frames 20% on left to show contents of pages, 60% in center to show body of page, remaining on right to show remarks.
6. Create a simple form that will show all the INPUT METHODS available in HTML.
7. Create a sample code to illustrate the Embedded, External, and Inline style sheets for your web page.
8. Write down simple JAVA Script using timeout such that image will be changed after every 1 ms at a specified position.
9. Design a registration form and validate its field by using JAVA script.
10. Write an XML example of given tree that demonstrates the creation of user-designed tags and display it in a browser.
11. college, employee, fname, lname, joindate, bdate, age, salary (with atleast 3 elements)
12. Write a program in XML for creation of DTD which specifies a particular set of rules.
13. Create a bean student with attributes (first name, last name, age, class). In another JSP page display the bean values using <jsp:usebean>.
14. Write a program to use JDBC connectivity program for maintaining database by

sending queries through JSP Page.

15. Use ad-rotator to change advertisements on client-side request. (ASP.NET)
16. Implement Session tracking using user authentication in ASP.NET.
17. Write a PHP script to create a database Student DB.
18. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.

Books & References

1. Uttam K. Roy, Web Technologies, 1/e, Oxford University Press, USA.
2. M. Srinivasan, Web Technology: Theory and Practice, Pearson Education India.
3. Deitel, Deitel and Nieto, Internet, and Worldwide Web - How to Program, 5th Edition, PHI, 2011.
4. Ralph Moseley & M. T. Savaliya, Developing Web Application- Second Edition, Wiley.
5. Miller/Kirst, Web Programming Step by Step, Stepp, 2nd edition, 2009.
6. Ullman, PHP for the Web: Visual Quick Start Guide, Pearson Education, 4th edition, 201
7. www.w3c.org
8. www.w3schools.com

   Readings:

   Various journal and conference articles, research reports, and book excerpts as appropriate.
9. Ivan Bayross, Web Enabled Commercial Application Development Using HTML, DHTML, JAVA Script, Perl & CGI, BPB Publication, 2005.
10. Hans Bergsten, JAVA Server Pages, O‟Reilly.

BAS-13 INDUSTRIAL SOCIOLOGY

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of sociology, its problems and understanding.
2. To identify, formulate and solve the real-life problems with positive attitude.
3. To inculcate the habit of learning and developing the industrial problems from sociological perspectives.

Topics Covered

UNIT-I **6L**

Introduction to Industrial Sociology Nature, Scope and importance of Industrial Sociology, Development of Industrial Sociology, and other social sciences. Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim

UNIT-II **6L**

Rise and development of industry Early industrialisation- Types of productive systems-Evolution of Productive system and Development of Industry, Primitive Stage, Agrarian economy Stage, Handicrafts Stage, Guild System, Feudal or Manorial System, putting out System, Industrial Revolution, Industrialisation Causes and Consequences.

UNIT-III **6L**

Contemporary issues in Industrial Sociology Industrial Policy Resolutions Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, changing nature of work and organization, Industrial Grievances, Industrial conflicts, Industrial disputes in India, Strike and Lock-out, Promote industrial Peace. Industrial Policy Resolutions.

UNIT-IV **6L**

Contemporary issues in Industrial Sociology Industrial Policy Resolutions Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, changing nature of work and organization, Industrial Grievances, Industrial conflicts, Industrial disputes in India, Strike and Lock-out, Promote industrial Peace. Industrial Policy Resolutions.

Books & References

1. Durae, Pravin. (2013). Dorling. Kindersley (India) P. Ltd. Pearson education in South Asia.
2. Archana Despandey (2010). Industrial Sociology., Sun India Publications, New Delhi.
3. Ramaswamy, E.A. and Ramaswamy, U. (1981), Industry and Labour, OU Press

4. Dhanagare, D.N., Themes and Perspectives in Indian Sociology, Rawat
5. Chandoke, Neera & Praveen Priyadarshi (2009), Contemporary India: Economy, Society and Politics, Pearson

MBA-151 ADVANCED PROFESSIONAL WRITING

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand professional writing by studying management communication contexts and genres, researching contemporary business topics, analyzing quantifiable data discovered by researching, and contructing finished professional workplace documents.
2. Recognize, explain, and use the formal elements of specific genres of organizational communication: white paper, recommendation and analytical reports, proposals, memorandums, web pages, wikis, blogs, business letters, and professional documents.
3. Understand the ethical, international, social, and professional constraints of audience style, and content for writing situations a.) among managers or coworkers and colleagues of an organization, and b.) between organizations, or between an organization and the public.

Topics Covered

UNIT-I **9L**

Language Vs communication: Communication as coding and decoding-signs and symbols-verbal and non-verbal symbols - Language & communication; Types of Communication-functional. Situational, verbal and non-verbal, interpersonal, group, interactive, public, Mass Communication.

Thinking and Articulation- cognitive, affect, critical, creative aspects of articulation.

Skills of Language Acquisition: Natural Language Acquisition Skills: Listening. Speaking, Reading & Writing (LSRW, Language Acquisition Through Training Listening. Speaking, Reading. Writing Grammar & Vocabulary (LSRWGV)- Recap of word and thought match exercises Common Confusable; active and passive voice; phrasal verbs and prepositional verbs. Recap of language skills-vocabulary.

Phrase, Clause & Sentence: The Sentence, The paragraph: Structure, types and linking. Professional Vocabulary, Impersonal Style, Scientific Attitude Plain Statement, Interesting Composition, Miscellaneous Exercises, Definition, Description, Description of a process, Diagrams, Explanations,

Professional/ Technical Communication-Simplicity, Clarity and Conciseness of a Presentation, Blending of Artistic/Professional Writing and Technical Writing, Usages in Grammar, Avoiding gender, racial and other forms of bias in Professional Writing. Pre-Writing, Drafting and Re-writing.

UNIT-II **9L**

Professional Technical Paper Writing: Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organising References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Paper Writing:** Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing-Title, Keywords, Synopsis, Preface and abstract. Writing Research Article & Methodology.

Thesis/Dissertation Writing: Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen-Thesis and Research Paper, Chapters and Sections-Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis.

Processing Professional Data: Data Collection, Literature Review, Data Analysis. Drafting Data & Deriving Inferences.

UNIT-III **9L**

Professional Drafting: Letters Formal and Informal Letters, Parts of a Letter, Types of Letters, Stylistic Fonts in Letter Writing: Business Letters, Examples of Letter-Writing, Job Applications & Covering Letters.

Conducting Professional Meeting: Pre meeting Preparation, During Meeting & Post Meeting follow-ups Notice. Circular, Agenda: Deciding Agenda, Preparing Minutes & Drafting follow-ups.

Career & Correspondence: Developing a Professional C.V. Bio Data & Resume Building. Report Writing. Kinds of Report, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.

Presentation Delivery Tools: Designing the Presentation, Establishing the Objectives. Making Professional Power Point Presentations, Signalling Structure of Presentation through Sentences and One Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Band, Flip Charts, Diagrams, Preparing Cards.

UNIT-IV **9L**

Technical seminar- purpose, modes, and methods, Interviewing skills-body language, gesture, posture, tips, and tactics of interview.

Case study- objectives, methods, examples of various case-study.

Audience Analysis: Industrial vs. non-industrial users; Exploring primary, secondary, tertiary users in contexts of production and use; Creating personas; Multicultural issues; Analyzing real-world examples. Estimating, tracking, and managing tech writing projects. Determine the project scope, Estimates and schedules, Assemble the team, Provide resources and leadership, Evaluate the project, Appendixes and Annexure. References. Peripherals- Official Formalities, Rights and Permission, Certificate and Copyright, Dedication, Acknowledgement, Correspondences. Change Management & Argumentative Writing.

Professional Projects: Elements of a Professional Project Making: Making a final Project on topics given by the instructor, Result & Discussion.

Cyber Identity & Professional Netiquettes: Writing Emails, Blogs on Social media Video Conferencing.

Recommended Books

1. Gibaldi, Joseph. *The MLA Handbook for Writers of Research Papers*, Modem Language Association of America, US 2016.
2. Schwarzman Steven A. *Technical Writing Management: & Practical Guide* Create Space Independent Publishing Platform, 2011.
3. Acharya Anita, *Interview Skills-Tips & Techniques*. Yking Books, Jalpur, 2012,
4. Hamilton Richard. *Managing Writers*. Penguin, India, 2009.
5. Sharma R.S. *Technical Writing Radha Publications*, New Delhi, 2007.
6. B. N. Basu, *Technical Writing*, PHI Learning Pvt. Ltd... New Delhi, 2008,
7. McGraw S. J. *Basic Managerial Skills for All Ed. 08.* Prentice Hall of India New Delhi, 2008
8. Dubey Arjun et al. *Communication for Professionals* Alfa Publications, Delhi, 2016 –
9. Sharma R.C. & Mohan Krishna, *Business Correspondence and Report Writing* Tata McGraw Hill New Delhi, 2017.
10. Chhabra T.N. *Business Communication* Sun India Publication New Delhi, 2018.
11. Murphy and Hildebrandt, *Effective Business Communication*, Tata McGraw Hill New Delhi, 2008.

MHM-104/MAS-109 FOREIGN LANGUAGE-FRENCH

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of French language, its problems and understanding.
2. To identify, formulate and solve the real-life problems with positive attitude.
3. To inculcate the habit of learning and developing the French knowledge

Topics Covered

UNIT-I **6L**

Alphabets and numbers Simple Grammar: Basics of French conversation (To greet a person, introducing oneself, Asking basic information)

UNIT-II **6L**

Simple Grammar: Name and locate objects, colours, and simple description of people.
Simple Grammar: Asking for directions, Giving suggestions.

UNIT-III **6L**

Simple Grammar: Indicate date and time. Asking and giving information on one's profession and activities.

UNIT-IV **6L**

Simple Grammar: Use of past tense. Narrating past events. Giving one's opinion.

Books & References

1. Taxi‖ – Guy Cappelle and Robert Menand.
2. NSF I (Nouveau sans frontières) - Philippe Dominique & Jacky Girardet.
3. Nouvel Espace I - Guy Cappelle
4. Cadences I – D. Berger & L. Mérieux

MHM-105/MAS-110 FOREIGN LANGUAGE-GERMAN

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of German Language, its problems and understanding
2. To identify, formulate and solve the real-life problems with positive attitude
3. To inculcate the habit of learning and developing the German knowledge

Topics Covered

UNIT-I **6L**

- Alphabets and numbers (1 - 20)
- Simple Grammar: Articles (Definite, Indefinite, Negative), Nouns, Gender; Singular andplural. Conjugation of the auxiliary verb –To be‖ —Sein‖
- Contextual Vocabulary and Dialogue: Greeting, Self-Introduction, Simple questions.
- Hard Facts of Germany: (i) Fall of Berlin Wall (ii) Unification of Germany

UNIT-II **6L**

- Numbers (20 – 100)
- Simple Grammar: Conjugation of verbs, pronouns (personal and interrogative), Present tense, Imperative tense, auxiliary verb —To have‖, —Haben‖, Nominative and accusative cases.
- Contextual Vocabulary and Dialogue: At the Railway Station, Airport.
- Hard Facts of Germany: Education System.

UNIT-III **6L**

- Simple Grammar: Modal verbs, Past and perfect tenses, Dative case.
- Contextual Vocabulary and Dialogue: Idiomatic expressions, one's family and background, Reading the time, days, months and year
- Hard Facts of Germany: Germany and the European Union.

UNIT-IV **6L**

- Simple Grammar: Irregular verbs, Separable and inseparable verbs, Reflexive pronouns, Possessive pronouns Revision of Grammar learn so far.
- Contextual Vocabulary and Dialogue: Daily life, Meals, how to place an order in a restaurant.
- Hard Facts of Germany: Presentation of topics on German Civilization discussed earlier.

Books & References

1. Komm Mit‖ – Level I – Holt, Rinehart & Winston
2. Moment Mal!‖ - Level I
3. Themen‖ - Level I
4. Facts about Germany‖
5. Deutsch FÜr Ausländer‖ – Schulz-Griesbach

MHM-106/MAS-111 FOREIGN LANGUAGE-SPANISH

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of various facets of Spanish Language, its problems and understanding.
2. To identify, formulate and solve the real-life problems with positive attitude.
3. To inculcate the habit of learning and developing the Spanish knowledge.

Topics Covered

UNIT-I **6L**

- Alphabet
- Introducing oneself
- Pronunciation
- Nouns, gender of the nouns
- Singular and plural of the nouns Articles: definite and indefinite
- Subject pronouns
- Number (1~100)
- Name of months and days

UNIT-II **6L**

- Present indicative of the two auxiliaries: Ser/Estar – Tener
- Hay / Están / Dónde está /están
- Adjectives
- The interrogative adjectives and pronouns (cuanto? cual?)
- Nationalities
- Idiomatic expressions with ―Tener‖ (Tener hambre/ sed/...)
- Culture and civilization

UNIT-III **6L**

- Present indicative of the three conjugations (AR-ER-IR)
- Negation
- Interrogative sentences
- Present indicative of a few common irregular verbs
- Present indicative of ―ir‖ and ―venir‖
- Possession (de/ de quién)
- Culture and civilization

UNIT-IV **6L**

- Prepositions and their combination with the articles
- Possessive adjectives and pronouns
- Use of prepositions with ―ir‖ and ―venir‖
- Present indicative of the verbs. Querer- Poder- Deber/Tener que
- Asking and expressing time
- Family vocabulary (family relations)
- Culture and Civilization

Books & References

1. Virgilio Borobio, Nuevo ELE 1, Curso de Español para extranjeros,2002, SM, Madrid.
2. Luis Aragonés y Ramón Palencia: Gramática de uso del Español, teoría y práctica, Ed. SM, Madrid.
3. Lisa Prange y Francisca Pichardo Castro: Por Turnos, Actividades para aprender español jugando, Ed. Difusión, Madrid.
4. Chamorro, M. D.: Abanico, libro del alumno, Ed. Difusión, Madrid.
5. Deutsch FÜr Ausländer – Schulz-Griesbach

BCS-73/BCS-69 NEURAL NETWORK & FUZZY SYSTEM

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits:	4

Course Assessment methods: Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test and One Major Theory Examination.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Basics of ANN and its learning algorithms.
2. Fuzzy principles and relations.
3. Genetic algorithms and its applications.
4. Hybrid systems and usage of MATLAB toolbox

Topics Covered

UNIT-I **9L**

Neural Networks-1(Introduction &Architecture) Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks, Various Learning Techniques; Perception and Convergence Rule, Auto-Associative and Hetro-Associative Memory

UNIT-II **9L**

Neural Networks-II (Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model; Back Propagation Learning Methods, Effect of Learning Rule Co-Efficient; Back Propagation Algorithm, Factors Affecting Back-propagation Training, Applications.

UNIT-III **9L**

Fuzzy Logic-I (Introduction) Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion, Membership Functions, Interference in Fuzzy Logic, Fuzzy If-Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications & Defuzzification's, Fuzzy Controller, Industrial Applications.

UNIT-IV **9L**

Genetic Algorithm (GA) Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications

Books & References

Textbooks

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, Prentice Hall of India.
2. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press.
3. Siman Haykin, Neural Networks, Prentice Hall of India
4. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India.
5. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, John Wiley & Sons, 01-Jun-2007

Reference books

1. Hertz J. Krogh, R.G. Palmer, Introduction to the Theory of Neural Computation, Addison-Wesley, California, 1991
2. Freeman J.A. & D.M. Skapura, Neural Networks: Algorithms, Applications and Programming Techniques, Addison Wesley, Reading, Mass, (1992)

BCS-15 DATABASE MANAGEMENT SYSTEMS

Course category:	Audit Course (AC)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voice and One Minor test and One Major Theory & Practical Examination

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. List and define the fundamental concepts of database management system.
2. Manually execute a given (simple) database design a transaction over it.
3. Manually infer the type of a given (simple) database transaction.
4. Implement (simple) algorithms and data structures as database transaction.
5. Design (large) databases that are modular and have reusable components.
6. Explain on a simple problem how to apply concurrency control over concurrent database transactions.

Topics Covered

UNIT-I **9L**

Introduction: An Overview of Database Management System, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language,

DML, Overall Database Structure.

Data Modeling using Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of An ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree

UNIT-II **9L**

Relational Data Model and Language: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus.

Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins,

Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

UNIT-III **9L**

Database Design &Normalization: Functional Dependencies, Normal Forms, First, Second, Third Normal Forms, BCNF, Inclusion Dependence, Loss Less Join Decompositions, Normalization using FD, MVD, and JDS, Alternative Approaches to Database Design.

UNIT-IV **9L**

Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling.

Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.

Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.

EXPERIMENTS

1. Exercises to be based on Sybase / Oracle / Postgres / VB / Power Builder / DB2 / MS-Access.
2. Applications involving vendor development systems, stores management system, finance management etc.
3. Creation and querying of database tables for following cases. .
   i. Write SQL queries using logical operations (=,<,>,etc)
   ii. Write SQL queries using SQL operators
   iii. Write SQL query using character, number, date and group functions

iv. Write SQL queries for relational algebra
v. Write SQL queries for extracting data from more than one table
vi. Write SQL queries for sub queries, nested queries
vii. Write program by the use of PL/SQL
viii. Concepts for ROLL BACK, COMMIT & CHECK POINTS
ix. Create VIEWS, CURSORS and TRGGERS & write ASSERTIONS.
x. Create FORMS and REPORTS

4. Design of tables by normalization and dependency analysis.
5. Writing application software with host language interface.

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