H.P. TECHNICAL UNIVERSITY

HAMIRPUR (HP)

Syllabus

[Effective from the Session: 2012-13]

B. Tech. (Electrical & Electronics Engineering)

Group B

1st Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
NS-101	Engineering Mathematics-I	3	1	0	4	100	50	150
NS-102	Engineering Physics-I	3	0	1	4	100	50	150
NS-103	Engineering Chemistry	3	1	0	4	100	50	150
HS-101	Disaster Management and Environmental Science	3	0	2	5	100	50	150
BE-101	Basic Electrical and Electronics Engineering	3	1	0	4	100	50	150
BE-102	Basic Mechanical Engineering	3	1	0	4	100	50	150
(Practicals / Drawing / Design)						**Practical**	**Sessional**	
NS-103 (P)	Engineering Chemistry Lab	0	0	2	2	25	25	50
BE-101 (P)	Basic Electrical Engineering Lab	0	0	2	2	25	25	50
BE-102 (P)	Basic Electronics Engineering Lab	0	0	2	2	25	25	50
WS-102	Workshop Practice-II	0	0	3	3	25	25	50
Total					**34**			**1100**

2nd Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
NS-104	Engineering Mathematics – II	3	1	0	4	100	50	150
NS-105	Engineering Physics-II	3	1	0	4	100	50	150
BE-103	Engineering Drawing and Graphics	1	0	6	7	100	50	150
HS-102	Communication Skills	2	1	0	3	100	50	150
BE-104	Principles of Computer Programming & C^{++}	3	1	0	4	100	50	150
BE-105	Engineering Mechanics	3	1	0	4	100	50	150
(Practical's / Drawing / Design)						**Practical**	**Sessional**	
NS-105 (P)	Engineering Physics Laboratory	0	0	2	2	25	25	50
HS-102 (P)	English Language Laboratory-I	0	0	2	2	25	25	50
BE-104 (P)	Computer Programming Laboratory	0	0	2	2	25	25	50
WS-101	Workshop Practice-I	0	0	3	3	25	25	50
Total					**35**			**1100**

All the students shall take up a minimum for 4 weeks duration project in the workshop. The same shall be evaluated in the 3rd semester.

3rd Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
HS-203	Human Values and Professional Ethics	2	0	2	4	100	50	150
NS-206	Engineering Mathematics-III	3	1	0	4	100	50	150
EE-211	Transmission & Distribution of Electrical Power	3	1	0	4	100	50	150
EE-212	Circuit Theory	3	1	0	4	100	50	150
EE-213	Electrical Engineering Materials and Applications	3	1	0	4	100	50	150
EC-211	Digital Electronics	3	1	0	4	100	50	150
(Practical's / Drawing / Design)						**Practical**	**Sessional**	
EE-211(P)	Transmission & Distribution of Electrical Power Lab	0	0	2	2	25	25	50
EE-212(P)	Circuit Theory Lab	0	0	2	2	25	25	50
EC-211(P)	Digital Electronics Lab	0	0	2	2	25	25	50
HS-202 (P)	Communication & Professional Skills Lab-II	0	0	2	2	25	25	50
Total					**32**			**1100**

4th Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
HS-201	Engineering Economics	3	1	0	4	100	50	150
NS-207	Numerical Methods for Engineers	3	1	0	4	100	50	150
EE-221	Electrical Machines-I	3	1	0	4	100	50	150
EE-222	Power Electronics	3	1	0	4	100	50	150
EE-223	Signals & Systems	3	1	0	4	100	50	150
EE-224	Electrical Measurement & Measuring Instruments	3	1	0	4	100	50	150
(Practical's / Drawing / Design)						**Practical**	**Sessional**	
EE-221(P)	Electrical Machines-I Lab	0	0	2	2	25	25	50
EE-222(P)	Power Electronics Lab	0	0	2	2	25	25	50
EE-224(P)	Electrical Measurement & Measuring Instruments Lab	0	0	2	2	25	25	50
ECA-201	Extra Curricular Activity	0	0	2	2	25	25	50
Total					**32**			**1100**

Field Visit shall be compulsory to all students of 2nd year once in a year during or after 4th semester.

Survey camp of minimum four (4) weeks duration shall be conducted after 4th Semester for Civil Engineering students. For students of other branches community project at this level will be conducted be included. The Evaluation of same shall be done during 5th Semester.

5th Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
EE-300	Open Elective	3	0	0	3	100	50	150
EE-311	Electrical Machine-II	3	1	0	4	100	50	150
EE-312	Transducers & Signal Conditioning	3	1	0	4	100	50	150
EE-313	High Voltage Techniques & HVDC	3	1	0	4	100	50	150
EE-314	Electromagnetic Field Theory	3	1	0	4	100	50	150
EC-311	Microprocessor Theory and Applications	3	1	0	4	100	50	150
(Practical's / Drawing / Design)						**Practical**	**Sessional**	
EE-311(P)	Electrical Machine-II Lab	0	0	3	3	25	25	50
EE-312(P)	Transducers & Signal Conditioning Lab	0	0	3	3	25	25	50
EC-311(P)	Microprocessor Theory and Applications Lab	0	0	2	2	25	25	50
HS-300	Community Project/ Survey Camp	0	0	0	0	25	25	50
Total					**31**			**1100**

Open Elective to be opted from list below but one which is not offered by his Department

Sr. No.	Open Elective	Sub. Code
1.	Energy Assessment and Auditing	EE-300 (a)
2.	Total Quality Management	ME-300 (b)
3.	Optimization methods for Engineering System	HU-300 (c)
4.	Remote Sensing & GIS	CE-300 (d)
5.	Operating Systems	CS-311

6th Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
HS-301	Principles of Management and Critical Thinking	3	0	2	5	100	50	150
EE-321	Switchgear & Protection	3	1	0	4	100	50	150
EE-322	Control Engineering-I	3	1	0	4	100	50	150
EE-323	Electrical Power Generation	3	1	0	4	100	50	150
EE-324	Electrical Drives and Facts	3	1	0	4	100	50	150
EC-321	Microcontrollers & Embedded Systems	3	1	0	4	100	50	150
(Practical's / Drawing / Design)						**Practical**	**Sessional**	
EE-321(P)	Switchgear & Protection Lab	0	0	2	2	25	25	50
EE-322(P)	Control Engineering Lab	0	0	2	2	25	25	50
EC-321(P)	Microcontrollers & Embedded Systems Lab	0	0	2	2	25	25	50
	Total				**31**			**1050**

$$ - Industrial Training of 8 weeks duration after 6th Semester

7th Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
EEE-411	Elective-I	3	1	0	4	100	50	150
EE-412	Electrical Machine Design	3	1	0	4	100	50	150
EE-413	Biomedical Engineering	3	1	0	4	100	50	150
EE-414	Power System Operation & Control	3	1	0	4	100	50	150
EE-415	Communication Engineering	3	1	0	4	100	50	150
(Practical's / Drawing / Design)						**Practical**	**Sessional**	
EE-412(P)	Electrical Machine Design Lab	0	0	3	3	50	50	100
EE-413(P)	Biomedical Engineering Lab	0	0	2	2	25	25	50
EE-496	Industrial Training Viva	0	0	0	0	50	50	100
EE-497	Seminar	0	0	2	2	--	50	50
EE-498	Project-I	0	0	6	6	50	50	100
Total					**33**			**1150**

During winter break there shall be a field visit compulsory to all students of 7th semester, 4th year.

Elective-I
EEE-411(a) – Digital Control System
EEE-411(b) –Power Plant Engineering [Syllabus is same as /EE-411(b)]
EEE-411(c) – Industrial Control

8th Semester

Course No.	Subject	L	T	P/D	Hrs.	Exam Schedule		Total
						Theory	Sessional	
EEE-421	Elective-II	3	1	0	4	100	50	150
EE-422	Computer Applications To Power System Analysis	3	1	0	4	100	50	150
EE-423	Control Engineering-II	3	1	0	4	100	50	150
EE-424	Digital Signal Processing	3	1	0	4	100	50	150
(Practical's / Drawing / Design)						**Practical**	**Sessional**	
EE-421(P)	Computer Applications To Power System Analysis Lab	0	0	2	2	50	50	100
EE-424(P)	Digital Signal Processing Lab	0	0	2	2	25	25	50
EE-499	Project-II	0	0	6	6	100	50	150
GP-400	General Proficiency	0	0	0	0	--	100	100
Total					**26**			**1000**

Elective-II
EEE-421 (a) – Digital Image Processing
EEE-421 (b) – Advanced Power Electronics
EEE-421 (c) – Microwave Engineering

Engineering Mathematics-I (NS-101)

Course Code	**NS-101**	**Credits- 04**	**L - 3, T- 1, P - 0**
Name of Course	**Engineering mathematics-I**		
Lectures to be delivered	**52 (L-39, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

Instructions

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed.

Section-A

1. MATRICES

Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Consistency of linear system of equations, Rank of a matrix, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms and its reduction to canonical form.

Section-B

2. DIFFERENTIAL CALCULUS

Indeterminate forms, Taylor's and Maclaurin's series, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Maxima and minima of functions of two variables, Method of undetermined multipliers.

Section-C

3. INTEGRAL CALCULUS

Reduction formulas, Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Change of variables, Triple integrals and their applications, Change of variable, Beta and Gamma functions and their relationship.

Section-D

4. COMPLEX NUMBERS

Applications of De Moivre's theorem, Root of a complex number, Exponential, Circular, Hyperbolic and Logarithmic functions of a complex variable, Inverse Hyperbolic functions, Real and imaginary parts of Circular and Hyperbolic functions, Summation of the series-'C+iS' method.

TEXT BOOKS

1. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
2. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS

1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Differential & Integral Calculus: by N. Piskunov, MIR Publications.
3. Calculus and Analytic Geometry, by Thomes, G.B, Finney, R.L. Ninth Edition, Peason Education.
4. Advanced Engineering Mathematics, by Peter. V. O‟ Nil, Wordsworth Publishing Company.
5. Advanced Engineering Mathematics, by Jain, R.K and Lyengar, S.R.K., Narosa Publishing Company.
6. Higher Engineering Mathematics, by Grewal, B.S., Khanna Publishers, New Delhi.
7. Engineering Mathematics, by Taneja, H.C., Volume-I & Volume-II, I.K. Publisher.

Engineering Physics-I (NS-102)

Course Code	**NS-102**	**Credits-4**	**L-3, T-0, P-1**
Name of the Course	**Engineering Physics-I**		
Lectures to be Delivered	**52 (1 Hr Each) (L=39, T=13 for each semester)**		
Semester End Examination	**Max Marks: 100**	**Min Pass Marks: 40**	**Maximum Time:3 hrs**
Continuous Assessment (based on sessional test (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For Candidates:** Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Section A

Interference-Coherent Sources, Two Beam Interference by Division of Wavefront- Fresnel Biprism Interference by Division of Amplitude - Newton's Rings, Michelson Interferometer.

Diffraction-Fraunhoffer Diffraction, Diffraction Through Single Slit, Plane Transmission Grating, Fresnel Diffraction, Fresnel Half Period Zone, The Zone Plate.

Polarization- Production of Polarized Light, Malus's Law, Double Refraction, Interference of polarized Light: Quarter Wave Plate And Half Wave Plate.

Section B

Particle Properties of Waves: Electromagnetic Waves, Maxwell Equations, Blackbody radiations, Photoelectric Effect, Compton Effect, Pair Production,

Waves Properties of Particles: De Broglie waves, Phase velocity, group velocity and Particle velocity. Relation between phase velocity and group velocity. Relation between group velocity and particle velocity. Particle Diffraction, Heisenberg's uncertainty principle and its physical significance (no derivation). Application of uncertainty principle (Non-existence of electron in the nucleus).

Section C

Quantum Mechanics: Postulates of quantum mechanics, The Wave Euation. Properties and Physical significance of a wave function. Probability density and Normalisation of wave function. , Schrodinger's equation: Time- Dependent form, Expectation Values, Operators, Schrodinger's equation: Steady- Stateform Eigen values and eigen function, Application of Schrödinger wave equation –Particle in a box, FinitePotential well, Tunnel Effect, Harmonic oscillator.

Section D

Nuclear Structure: Composition of nucleus, Nuclear Properties, Stable Nuclei, binding energy, Liquid Drop Model, Nuclear Forces.

Nuclear Reactions: Cross-section, Nuclear fission, moderators, nuclear reactors, Nuclear fusion in Stars, Fusion Reactors

Elementary Particles: Leptons,Hadrons, Elementary particle quantum numbers, Quarks, Field Bosons,

Cosmology: The Big Bang Theory, Evolution of Stars.

Text Books:

1. A.Ghatak: Optics,Tata Mcgraw Hill, 3rd edition.
2. Arthur Beiser, Concepts of Modern Physics ,6th Edition, Tata Mcgraw Hill-2009

Reference Books:

1. David J Griffith , Introduction to Electrodynamics, Pearson Prentice Hall.
2. Halliday, Resnick and Walker- Principles of Physics, Wiley India 9th Edition-2012

ENGINEERING CHEMISTRY (NS – 103)

Course Code	**NS-103**	**Credits- 04**	**L-03, T-01, P-0**
Name of Course	**Engineering Chemistry**		
Lectures to be delivered	**55 (L-42, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on Sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %)			**MM: 50.**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION –A

Electrochemistry: Electrical Conductance, Types of Electrolyte, Specific Conductance, Equivalent Conductance, Molar Conductance, Ionic Conductance (Kohlrausch Law), Factors Affecting Conductance, Transport Number, Interionic Attraction Theory of Conductance, Hydration of ions, Electrochemical Cell ,Electrode Potential, Standard Electrode Potential, Galvanic Cells, EMF of the Cell & Free Energy Change, Nernst Equation, Reference Electrodes (S.H.E,Calomel Electrode, Silver-Silver Electrode, Eletrochemical Series, Glass Electrode, Concentration Cell, types & applications of Concentration Cell, Batteries(primary cell, Secondary storage cell, Metal- Air Batteries), Fuel cell, hydrogen-oxygen fuel cell.

Phase Rule: Introduction, One Component System (water system, sulpher system) Two components System (lead-silver & Zinc- magnesium system), thermal Analysis.

SECTION – B

Water Treatment: Introduction, Sources of water, Impurities, Hardness Analysis, Oxidations, (BOD & COD), Boiler Corrosion Sewage & Treatment.

Corrosion and its Controls: Introduction, Types of corrosions, Electrochemical Theory, Pitting, Water Line, Differential Aerations corrosions, Stress Corrosions, Factors affecting Corrosions, Preventive measures.

SECTION – C

Instrumental Methods of Analysis

Introduction to spectroscopy; UV-Visible spectroscopy- Absorption laws ,Instrumentation, formation of absorption bands, Theory of electronic spectroscopy, Chromophore and auxochrome concept, fluorescence & phosphorescence, application of UV-Visible spectroscopy ; IR spectroscopy- Principle, theory of molecular vibrations, important features of IR spectroscopy

and applications; NMR-Principle, relaxation processes, Instrumentation, Shielding-desheilding effects, spin coupling, coupling constant, applications of NMR.

Fuel and Combustion: Introduction, class of fuels (Solid, Liquid and Gases) Coal and its origin, Analysis of Coals, Petroleum fuels, Cracking, Reforming, Octane no, Cetane no, Gaseseous fuel – Water gas, producer gas, bio gas, coal gas and oil gases

SECTION – D

Polymers Classification of polymers, types of polymerizations, plastics, some important commercial thermoplastics (polythene, polypropylene, polystyrene, polyvinylchloride, Teflon, plexiglass, polyurethanes), thermosetting (Bakelite, epoxy resin, Urea formaldehyde) Elastomers- synthetic rubbers, synthetic fibers.

Composite Materials

Introduction, Classification, Constituents of composites, Fiber reinforced composites, unidirectional fibre reinforced composites, short fibre reinforced composites, particle reinforced composites, important types of particulate composites, Failures of fiber reinforced composites, Advantages and applications of composites.

TEXT BOOKS:

1. Engineering Chemistry by Dr Ramesh Thakur and Dr.Subba Ramesh, Wiley India publisher
2. A Text Book of Engineering Chemistry by ShashiChawla, DhanpatRai& Sons.

REFERENCE BOOKS:

1. Engineering Chemistry by P C Jain & Monika Jain
2. Fundamental of organic spectroscopy by Y. R. Sharma
3. Spectroscopic methods by Williams and Fleming

DISASTER MANAGEMENT AND ENVIRONMENTAL SCIENCE (HS-101)

Course Code	**HS-101**	L-3, T-0, P-2	
Name of the Course	**Disaster Management and Environmental Science**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, P = 13 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Principles of Disaster Management. Natural Disasters such as Earthquake, Floods, Fire, Landslides, Tornado, Cyclones, Tsunamis, Nuclear, Chemical, Terrorism, Extra Terrestrial and other natural calamities. Hazards, Risks and Vulnerabilities. Assessment of Disaster Vulnerability of a location and vulnerable groups, National policy on disaster Management,

Section-B

Prevention, Preparedness and Mitigation measures for various Disasters, Post Disaster Relief & Logistics Management, Emergency Support Functions and their coordination mechanism, Resource & Material Management, Management of Relief Camp, Information systems & decision making tools, Voluntary Agencies & Community Participation at various stages of disaster, management, Integration of Rural Development Programmes with disaster reduction and mitigation activities.

Section-C

Renewable and non-renewable resources, Role of individual in conservation of natural resources for sustainable life styles. Use and over exploitation of Forest resources, Deforestation, Timber extraction, Mining, Dams and their effects on forest and tribal people. Use and over exploitation of surface and ground water resources, Floods, Drought, Conflicts over water, Dams- benefits and problems. Causes, effects and control measures of Air pollution, Water pollution, soil pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Section-D

Global Environmental crisis, Current global environment issues, Global Warming, Greenhouse Effect, role of Carbon Dioxide and Methane, Ozone Problem, CFC's and Alternatives, Causes of Climate Change Energy Use: past, present and future, Role of Engineers.

TEXT BOOKS:

1. Disaster Management By G. K. Ghosh A.P.H. Publishing Corporation
2. Environmental Studies, R Rajgopalan, Oxford University Press

REFERENCE BOOKS:

1. Modern Encyclopaedia of Disaster and Hazard Management By B C Bose Rajat publications.
2. Disaster Management By R.B. Singh Rawat Publications.
3. Disaster Management By B Narayan A.P.H. Publishing Corporation.
4. Environmental Studies, Daniels, Wiley Publication
5. Environmental Studies, Basak, Pearson Publication

Basic Electrical & Electronics Engineering (BE-101)

Course Code	**BE-101**		**L-3, T-1, P-0**
Name of the Course	**Basic Electrical & Electronics Engineering**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks:100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which willcover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus andeach question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION A

DC circuits:. Ohm's law , resistance, receptivity, series & parallel connections, star delta transformation, power dissipation in resistance, effect of temperature on resistance. Kirchhoff's laws Mesh laws; Mesh & Nodal analysis.

AC circuits: Generation of alternating voltage &currents, Sinusoidal signals, instantaneous and peak values, R.M.S. &Average value, phase angle, polar and rectangular, exponential and trigonometric representations of RL and C components,

Electrical Instruments and Devices: Voltmeter, Ammeter, Wattmeter, Energy meter, Inverters. Introduction to Domestic Electric Wiring

SECTION – B

Series and Parallel Circuits: A.C.Through resistance; inductance & capacitance. R-L; R-C & R-L-C series & parallel circuits, phasor diagrams. Power & power factor, series & parallel resonance. Problems by analytical as well as physical methods.

Three phase circuits: Three phase voltage & current generation, star & delta connections (balanced load), relationship between phase &line currents and voltages, phasor diagrams, measurement of power by two wattmeter methods.

A.C. And D.C. Machines: Principle, construction and working of transformer. Introduction to D.C and A.C. machines.

SECTION – C

Semiconductor Devices & Circuit: Classification of material; Energy band structure of conductors, insulators & semiconductor ;Classification of Semiconductor Mobility and conductivity, Intrinsic and extrinsic semiconductors and charge densities in semiconductors, current components insemiconductors, continuity equation. ; PN junction Characteristics&

Analysis ;diode rating ; Types of diodes – Zener diodes, Photodiodes, Light emitting diodes (LED's), Varactor diodes and tunnel diodes. Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Basic regulator supply using zener diode.

Transistors: Construction and characteristics of bipolar junction, transistors (BJT's)-Comm. Base, Comm. emitter, Comm. Collector configuration.

SECTION – D

Field Effect Transistor: Construction and characteristics of JFET.MOSFET construction and characteristics.

Integrated Circuits: Classification Of ICs; Monolithic ICs; OP Amp: Characterstics of Ideal OPAmp& application

Electronic Instruments: Role and importance of general purpose test Instruments, Electronic Millimeter, Cathode Ray Oscilloscope, Measurement of amplitude, Frequency and phase using CRO.

TEXT BOOKS:

1. Basic Electrical & Electronics Engineering –V Jegathesan , K Vinoth Kumar & R Saravanakumar, Wiley India
2. Basic Electrical & Electronics Engineering- B.L.Thereja
3. Fundamentals of Electrical & Electronics Engg., 2nd Edition by Smarajit Ghosh, PHI Learning Private Limited.

REFERENCE BOOKS:

1. Electronics devices and circuit theory by Robert Boylestad.
2. Electronics Devices and circuits by Millman&Halkias, TMH.
3. Basic Electronics by Debashis De, Pearson Education, 2010.
4. Electronics devices and circuit by Bhargava and Kulshtreshta, TTTI Series

BASIC MECHANICAL ENGINEERING (BE-102)

Course Code	**BE-102**	L-3, T-1, P-0	
Name of the Course	**Basic Mechanical Engineering**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time=3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus, and each question will carry 20% of the total marks of the semester end examination for the course.
   Note: The paper setter will be required to mention a note in the question paper that use of steam table, graphical plots are permitted.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Basic concept: Dimensions and units, thermodynamic systems, thermodynamic properties and process, thermodynamic equilibrium, energy-kinetic, potential and internal, heat and work, zeroth law, concept of temperature, definition of ideal gas, laws and properties of ideal gas.
First law of Thermodynamics: First law for control mass (closed system), internal energy as a property, enthalpy, specific heats, non-flow processes of ideal gases, cyclic process, first law for control volume (open system), applications of steady flow energy equation to engineering devices.

Section-B

Second law of Thermodynamics: Limitations of first law of thermodynamics, Kelvin- Planck and Clausius statements, their equivalence, application of statements of second law to heat engine, heat pump and refrigerator, reversible processes, reversible cycles, and carnot cycle, corollaries of the second law, thermodynamics temperature scale, Clausius inequality, entropy, principle of increase of entropy, availability and irreversibility.
Properties of Steam: Phase transformation, phase diagram, condition of steam- saturated steam, dry-saturated steam, wet steam, superheated steam, dryness fraction, property of steam, steam tables, use of Mollier charts , process of vapors and various process.

Section-C

Gas Power Cycles: Carnot, Diesel, Otto, Dual combustion, working of 2-stroke and 4-stroke engine, Air standard thermal efficiency, Concepts of mean effective pressure, indicated power and brake powerfor reciprocating engines.

Section-D

Introduction of Psychometry: The Gibbs Dalton law, Psychometric terms, Introduction of Psychometry Chart.

Introduction to Heat Transfer: Mechanisms – Conduction, Convection and Radiation, Introduction to Fourier's Law of heat conduction, Newton's law of cooling, Stefan-Boltzmann law.

Introduction to Fluid Mechanics: Fluid, properties of fluid, viscosity, Newton's law of viscosity, surface tension, types of fluid, buoyancy.

TEXT BOOKS:

1. Basic Mechanical Engineering by Basant Aggarwal and CM Aggarwal Wiley India.
2. Fundamentals of Mechanical Sciences: Engineering Thermodynamics and Fluid Mechanics by Mukherjee and Paul, PHI Learning.

REFERENCE BOOKS:

1. Thermodynamics – An Engineering Approach (SI Units) – Yunus. A. Cengel, Michael A. Boles, TMH New Delhi
2. Fundamentals of Thermodynamics –Sonntag, Borgnakke Van Wylen – Wiley India.
3. Engineering Thermodynamics by P.K. Nag, TMH, New Delhi
4. Thermodynamics by C.P. Arora, TMH, New Delhi
5. Fundamentals of Mechanical Engineering, 2nd Edition by G.S. Sawhney, PHI Learning Private Limited.

Engineering Chemistry Lab (NS-103(P))

Course Code	**NS-103(P)**	**Credits-2**	**L-0, T-0, P-2**
Name of the Course	**Engineering Chemistry Lab**		
Lectures to be Delivered	**26 hours of Lab. work (2 hrs. per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	Lab work 30% Lab Record 25% Viva/ Hands on 25% Attendance 20%		Max Marks: 25

Instructions for paper setter / candidates

Laboratory examination will consist of two parts:

Performing a practical exercises assigned by the examiner.

Viva-voce examination

Viva-voce examination will be related to the practicals performed / project executed by the candidate related to the paper during the course of the semester.

NOTE: At least 10 to 12 experiments to be performed.

List of Experiments

1. To determine the surface tension of the given liquid by drop number method by using stalgmometer and identify the given liquid.
2. To determine the insoluble, soluble and total solids in given sample of sewage.
3. To determine the solid carbon, volatile matter, ash content and percentage of moisture in given sample of coal by proximate analysis method and classify the coal.
4. To determine the total alkalinity in a given sample of water using a standard acid.
5. To determine the percentage of Chlorine in a given sample of $CaOCl_2$ which has been dissolved in one litre of solution..
6. To determine the surface tension of the two given unknown liquids by using Stalgmometer and identify the given liquid.
7. To determine the coefficient of viscosity of the given unknown liquids by using Ostwald's Viscometer and identify the given liquid.
8. To determine the coefficient of viscosity of the given lubricating oil using Red Wood Viscometer
9. To determine the coefficient of viscosity of the given lubricating oil using Seybolt Viscometer.
10. To determine the flash point and fire point of given sample of oil using Pens key Marten's apparatus.
11. To determine the amount of Chlorine in given sample of water approximate N/20 sodium Thiosulphate solution.
12. To determine the maximum wavelength of solution of cobalt chloride
13. To determine the Beer's Law and apply it to find the concentration of given unknown solution by spectra-photometer.
14. To determine the chemical oxygen demand of waste water.
15. To determine the half-life period of given radioactive sample using GM counter.

BASIC ELECTRICAL ENGINEERING LAB (BE– 101(P))

Course Code	**BE– 101(P)**		L-0, T-0, P-2
Name of the Course	**Basic Electrical Engineering Lab**		
Lectures to be Delivered	**26 hours of Lab. work (2 hrs. per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work30%, Lab Record 25%Viva/ Hands on 25%, Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner
2. Viva-voce examination

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To verify KCL and KVL.
2. To study various types of Electrical Meters.
3. To perform open circuit and short circuit test of Transformer.
4. Measurement of power by Three Voltmeter/Three Ammeter method.
5. Measurement of power in 3-phase system by two wattmeter method.
6. To perform direct load test of transformer and plot efficiency v/s load characteristics.
7. To perform direct load test of the DC shunt generator and plot load v/s current curve.
8. To study frequency response of series RLC circuit and determine resonance frequency and Q factor for various values of R,L,C.
9. To study frequency response of parallel RLC circuit and determine resonance frequency and Q factor for various values of R,L,C.

Note: All the practicals of Electrical should also be performed on breadboard.

BASIC ELECTRONICS ENGINEERING LAB (BE– 102(P)

Course Code	**BE– 102(P)**	Credits-2	L-0, T-0, P-2
Name of the Course	**Basic Electronics Engineering Lab.**		
Lectures to be Delivered	26 hours of Lab. work (2 hrs. per week)		
Semester End Examination	Max Marks: 25	Min Pass Marks: 10	Maximum Time: 3 hrs
Continuous Assessment	Lab work 30%, Lab Record 25% Viva/ Hands on 25% Attendance 20%		Max Marks: 25

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:

1. Performing a practical examination assigned by the examiner
2. Viva-voce examination

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. Familiarization with electronic components, and general purpose Laboratory equipment.
2. Use of CRO and function generator and calculation of amplitude, frequency, time period of different types of ac signals.
3. Verification of Junction Diode and Zener Diode characteristic and determination of static and dynamic resistance at the operating point
4. Verification of input and output characteristics of a Bipolar Junction Transistor and determination of the operating point on load line.
5. Verification of input and output characteristics of a Field Effect Transistor and determination of the operating point on load line.
6. Verification of Series and Parallel Resonance theory.
7. Operation of diode as different form of rectifier and effect of different types of passive filters on the output.
8. Determination of frequency response of a RC coupled amplifier and determination of bandwidth and signal handling capacity.
9. Use of OP-AMP as an inverting and non-inverting amplifier for different gains.
10. Verification of Uni-junction Transistor characteristics and relaxation oscillator
11. Rectifiers- Half wave , Full wave & Bridge rectifiers

Note: All the practicals should be performed on breadboard.

WORKSHOP PRACTICE-II (WS-102)

Course Code	**WS– 102**	**L-0, T-0, P-3**	
Name of the Course	**Workshop Practice -II**		
Lectures to be delivered	**39 hours of Lab sessions in each semester**		
Semester End Examination	**Max. Marks: 25**		**Min. Pass Marks: 10**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS:

Laboratory examination will consist of two parts:
(i) Performing a practical exercises assigned by the examiner .
(ii) Viva-voce examination
Viva-voce examination will be related to the practicals performed / project executed by the candidate related to the paper during the course of the semester.

List of Experiments: -

Fitting Shop: -
1. Drilling and Tapping in a M.S. piece.
2. To make a male-female joint (Taper type) of mild steel.

Machine Shop: -
1. To perform boring operation on lathe machine.
2. To perform knurling and threading operation on lathe machine.
3. Step turning operation on a lathe machine.

Carpentry and Pattern making Shop: -
1. To make a single piece pattern of connecting rod.
2. To make a self-cod pattern.
3. To make a split pattern.

Welding Shop: -
1. To make a V butt joint in horizontal position.
2. To make a V butt joint in vertical position.
3. To perform Gas welding operation.

Smithy and Forging: -
1. To make a cube from a circular bar.
2. To make a tong using hot forging operations.
3. To perform drawing down operation.

Foundry Shop: -
1. To make a mould and perform casting operation.
2. Study of casting defects and its remedies.

Sheet Metal Working Shop: -
Blanking and piercing die construction, press work materials, strip layout, bending dies, forming dies, drawing operations, single and double action draw dies.

1. To make a Ring by Piercing.
2. To make a square shaped object by Bending and Forming Operation.
3. To Draw a Wire.

Suggested Reading: -

1. Workshop Technology by Chapman
2. Manufacturing Processes by Begman
3. Manufacturing Materials and Processes by J. S. Campbell

IInd Semester
Engineering Mathematics-II (NS-104)

Course Code	**NS-104**		**L - 3, T- 1, P - 0**
Name of Course	**Engineering mathematics-II**		
Lectures to be delivered	**52 (L-39, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

Instructions

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed.

Section-A

INFINITE SERIES: Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D'Alembert's ratio test, Cauchy's root test (Radical test), Integral test, Raabe's test, Logarithmic test, Gauss's test] (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence, absolute convergence and Conditional convergence.

Section-B

FOURIER SERIES: Euler's formula, Conditions for a Fourier expansion, Dirichlet's conditions, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula.

Section-C

LINEAR DIFFERENTIAL EQUATIONS: Brief review of first order ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degree, Clairaut's equation, Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations).

Section-D

VECTOR CALCULUS: Curves in space, curvature and torsion, Scalar and vector point functions, Differentiation of vectors, Vector operator Del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl, Line, surface and volume integrals, Green's Theorems, Stokes and GaussTheorems and their verifications and applications. Scalar potential, solenoidal and irrotational fields.

TEXT BOOKS

1. Advanced Engineering Mathematics by ErwinKreyszig, John Wiley and Sons, N.C., New York.
2. Advanced Engineering Mathematics by R. K. Jain & S. R. K Iyengar, Narosa Publishing House.

REFERENCE BOOKS

1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Higher Engineering Mathematics byB S Grewal,Khanna Publishers, New Delhi.
3. Differential & Integral Calculus: by N. Piskunov, MIR Publications.
4. Calculus and Analytic Geometry by Thomes, G.B, Finney, R.L. Ninth Edition, Pearson Education.
5. Advanced Engineering Mathematics byPeter. V. ONil, Wordsworth Publishing Company.
6. Vector Calculus by C. E. Weatherburn. John Wiley and Sons, NC, New York.
7. Differential Equations by Shepley L. Ross, John Wiley & Sons, New York.

Engineering Physics– II(NS – 105)

Course Code	***NS-105***		**L-3, T-1, P-0**
Name of the Course	***Engineering Physics– II***		
Lectures to be delivered	***52 (1Hr.each) (L = 39, T = 13 for each semester)***		
Semester End Examination	***Max. Time:3 hrs.***	***Max. Marks: 100***	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

Crystal Structure: Space lattice, Bravais lattice - unit cell, primitive cell. Lattice parameters. Crystal systems. Direction and planes in a crystal.Miller indices. Expression for inter-planar spacing.Co-ordination number. Atomic packing factor. Bragg's Law.Determination of crystal structure by Bragg's x-ray spectrometer. Crystal structures of NaCl, and diamond.

Free electron theory: Elements of classical free electron theory and its limitations. Quantum theory of free electrons, Fermi level, density of states, fermidirac distribution function, Thermionic emission, Richardson's equation.

(10 Lectures) & (Text Book-1)

SECTION – B

Band Theory of Solids: Origin of energy bands, Periodic Potential in a crystal, Wave function in a periodic potential, kronig, Penney Model (qualitative), E-K diagrams, Brillouin Zones, Effective mass of electron, Concept of negative effective mass and holes, Classification into metals, semiconductors and insulators, fermi energy and its variation with temperature.

(9 Lectures) & (Text Book-1)

SECTION – C

Dielectric and Magnetic Properties of Materials: Dielectric polarization, dielectric constant, types of polarization, electric field, electric displacement and dielectric polarization vector & relation between them, Gauss;s law in the presence of dielectric, Behavior of dielectric in alternating field- simple concepts, Atomic Magnetic Moments, Classification of magnetic materials, Dia, para, and ferromagnetic materials, domains, B-H graph in ferromagnetic

materials Anti-ferromagnetism &ferrimagnetisms, . Soft and Hard magnetic materials. Ferrite and their applications.

Superconductivity: Temperature dependence of resistivity in superconducting materials. Effect of magnetic field (Meissner effect). Type I and Type II superconductors. BCS theory (qualitative), High temperature superconductors, Applications of superconductivity.

(12 Lectures) & (Text Book-1)

SECTION – D

Lasers: Spontaneous and stimulated emission, Einstein's Coefficients, Characteristics of Laser beam, Population inversion, Pumping Techniques, Components of a laser system, Ruby Laser and He-Ne Lasers

Fiber Optics: Basics of fiber optics, Total Internal Reflection, Acceptance angle, Numerical aperture, Single mode & Multimode fibres, Step index and Graded index fiber, pulse Dispersion in optical fibres, Attenuation in Optical Fibres, applications of optical fibres.

(8 Lectures) & (Text Book-2)

Text Books:

1. Rajnikant: Applied Solid State Physics, Wiley India Pvt Ltd.
2. A. Ghatak: Optics,Tata Mcgraw Hill, 3rd edition.

Reference Books:

1. Charles Kittel: Introduction to Solid State Physics, John Wiley & sons Inc.
2. S. O. Kasap, Principle of Electronic materials and Devices.

ENGINEERING DRAWING AND GRAPHICS (BE-103)

Course Code	**BE-103**	L-1, T-0, P-6	
Name of the Course	**Engineering Drawing and Graphics**		
Lectures to be delivered	**78 (1 Hr Each) (L = 13, P = 65 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:

1. **For Institutes:** There will be two sessions per week. 1st session will consist of one lecture and two hours of practice session. 2nd session will consist of three hours of practice session.

2. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

3. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Drawing Techniques and Scales: Various type of lines, principal of dimensioning, size and location as per IS code of practice (SP-46) for general Engg. Drawing. Practice of drawing, various types of lines and dimensioning exercises. Drawing exercises pertaining to symbols.Conventions and Exercise of lettering techniques.Free hand printing of letters and numerals in 3, 5, 8 and 12 mm sizes, vertical and inclined at 75 degree.Instrumental lettering in single stroke.Linear scale, Diagonal scale &vernier scale.

Points, Lines and Planes: Projection of Points, Lines and Planes: Concept of horizontal and vertical planes. First and third angle projections: projections of point and lines, true length of lines and their horizontal and vertical traces, projection of planes and their traces. Auxiliary planes.

Section-B

Projections of Solids: Right regular solids of revolution and polyhedrons etc. and their auxiliary views.

Sectioning of Solids: Principal of sanctioning, types of sanctioning and their practice on projection of solids, sectioning by auxiliary planes.

Section-C

Development of Surfaces: Development of surfaces of cylinders, cones, pyramid, prism etc. exercises involving development of unique surfaces like Y-piece, hopper, tray, truncated pieces etc.

Intersection of Surfaces: Intersection of cylinders, cones and prisms with their axes being vertical, horizontal or inclines. Exercise on intersection of solids-cylinder and cylinder, cylinder and cone, prism and prism.

Section-D

Isometric Projection: Concept of isometric views: isometric scale and exercise on isometric views. Practice of Orthographic projections.

Simple Trusses: Graphical Method.

TEXT BOOKS:

1. Engineering Drawing & Engg. Graphics byP. S. Gill, Kataria and Sons Millennium Edition.
2. Engineering Drawing Plane and Solid Geometry byN.D. Bhatt and V. M. Panchal, 44th Edition, 2002, Charotar Publishing House.

REFERENCE BOOKS:

1. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill.

Communication & Professional Skills in English (HS-102)

Course Code	***HS-102***	***Credits-3***	***L-3, T-1, P-0***
Name of the Course	***Communication & Professional Skills in English***		
Semester End Examination	**Max Marks: 100**	**Min Pass Marks: 40**	**Maximum Time: 3 hrs**
Continuous Assessment *(based on Sessional test (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)*			***Max Marks: 50***

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For Candidates:** Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E.

Section A

Essentials of communication:

The process of communication: communication competence, types and channels of communication – verbal and non-verbal, Importance of listening skills in communication: types of listening, barriers to listening, Barriers to communication and removal of these barriers, personal SWOT Analysis, Analyzing audience, role of emotions and body language in communication.

Section B

Written communication:

Enriching vocabulary, using vocabulary in different context, Essentials of strong writing skills, language and style of writing, characteristics of a good technical style, logical reasoning, Paragraph writing, Developing perspective: goals, objectives and principles of critical thinking.

Section C

Reading Comprehension:

Importance of reading: Eye movement, fixations, regression, visual wandering, right approach to reading, SQ3R method of reading, Precis writing, Comprehension, Essay writing.

Section D

Technical Communication:

Report writing: Importance, structure, drafting of reports, Business Writing: Sales letters, claim and adjustment letters, inviting/sending quotations, Tenders, Memorandum, Job Application letter, Preparing a personal resume, notices, agenda and minutes of meeting.

TEXT BOOKS:

1. An Introduction to Professional English and Soft Skills: by Bikram K. Das, Kalyani Samantray, Cambridge Press.
2. Business correspondence and Report Writing: by R. C. Sharma & Krishna Mohan

REFERENCE BOOKS:

1. Communication Skills, Sanjay Kumar and PushpLata, Oxford University Press.
2. Chrissie Wright (Ed.); Handbook of Practical Communication Skills; JAICO Books
3. Effective Communication and soft Skills, NitinBhatnagar and MamtaBhatnagar, Pearson Publication.
4. Communicative English for Engineers and professionals, NitinBhatnagar and MamtaBhatnagar, Pearson Publication.
5. Communication Skills and soft skills- An integrated approach, Kumar, Pearson Publication
6. Communication Skills for Engineers, Mishra, Pearson Publication
7. K.K.Sinha, Business Communication, Galgotia Publishing Company, New Delhi, 1999.
8. R.K.Bansal& J.B. Harrison, spoken English for India, Orient Longman.

Recommended Readings:

1. Business @ The Speed of thought, Bill Gates.
2. My Experiments with Truth, M.K.Ghandhi
3. Wings of Fire, A.P.J. Kalam
4. An Autobiography, JwaharLal Nehru.

Principle of Computer Programming & C++ (BE-104)

Course Code	**BE-104**	**Credits-4**	**L-3, T-1, P-0**
Name of the Course	***Principle of Computer Programming & C++***		
Lectures to be Delivered	**52 (1 Hr Each) (L=39, T=13 for each semester)**		
Semester End Examination	**Max Marks: 100**	**Min Pass Marks: 40**	**Maximum Time: 3 hrs**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max Marks: 50**

SECTION-A

Introduction to Computer:-Definition, Characteristics..Generation of Computers, Capabilities and Limitations.Introduction to Operating System.Basic Components of a Computer System-Control Unit, ALU, Input/output functions and characteristics. Memory Introduction, Classifications- Volatile Memory and Non- Volatile , Memory, ROM, RAM.

Input, Output and storage Units:-Computer Keyboard, Pointing Devices: Mouse, Trackball, Touch Panel, and Joystick, Light Pen, Scanners, Various types of Monitors.

Hard Copy Devices:- Impact and Non- Impact Printers- Daisy Wheel, Dot Matrix, Line Printer, Chain Printer. Non Impact Printers- DeskJet, Laser Printer, Virus : General introduction of virus and anti-virus .

SECTION-B

High Level Language and Low Level Language, Software and its different types- System Software, Application software.Compiler, Interpreter and Assembler. Introduction to algorithm and Flow chart: - Representation of an algorithm, flowchart symbols and flow chart, rules, advantage and limitations of flowchart and pseudo code. Testing and Debugging:-Definition of testing and debugging , types of program errors.

DOS : Internal and External Commands , Difference between External and Internal Commands.

SECTION-C

Introduction to C++ : Starting with C++, Features of C++ Procedure-oriented programming OOP vs. procedure-oriented programming Compiling, linking and running a C++ program.

Object-Oriented Programming Concepts: Abstraction , Inheritance, Polymorphism, Data Binding , Encapsulation., Classes and Objects Concept of a class ,Defining a class, Creating an object , Object Scope.

The Basics of C++ : Basic Data Types, User-defined Data Types, Variable Declarations, Variable Names Constants and its types , Character Constants , String Constants, Standard input and standard output Formatted input –cin and Formatted output – cout.

Working with Operators and Expressions: Operators, Arithmetic Operators, Relational Operators, Assignment Operator, Logical Operators, Increment and Decrement Operators (++ and --), 'Operate-Assign' Operators (+=, =, ...).

SECTION-D

Controlling the Program Flow: Decision control : if, if – else, if - else if . Loop Control : while, do – while, for, break,continue Case Control switch, goto.

Functions/Procedures: function,Returning values from functions,Arguments Passed by ValuePassing Addresses of Arguments,Concept of variable scope and scope rules,Global variables

Pointers and Arrays: Pointers,Pointer Initialization,Pointer Operators ,The & (and) Operator Understanding Arrays, Initializing Arrays.

Files: reading, writing text and binary files, pointers, character pointers, pointers to arrays, arrays ofpointer to structures.

TEXT BOOKS:

1. Fundamentals of Computers by Rajaraman, V., PHI Publication
2. Object oriented programming in C^{++} by Rajesh K. Shukla, Wiley India.

REFERENCE BOOKS:

1. The C++ programming language ,Bjarne Stroustrup ,Addison Wesley , 2000.
2. Basic Computer Engineering, Kogent learning solution Inc. Dreamtech Press.
3. Object oriented programming Principles and Fundamental, Gim Keogh and Mario Giannini, John Wiley.
4. Object oriented programming in turbo C^{++} ,Robbet Lofre, 4 Ed Pearson Publication.
5. Programming with C^{++}, D. Ravichandern, Tata Mcgraw Hill 1996.
6. Object oriented programming in C++, Nicolai M Josuetis, John Wiley.

ENGINEERING MECHANICS (BE-105)

Course Code	**BE – 105**	**L-3, T-1, P-0**	
Name of the Course	**Engineering Mechanics**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13, P=0 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus, and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Force, Moment, Center of gravity & Moment of Inertia: Idealization of Mechanics, Concept of Rigid Body and Elastic Body, Laws of Mechanics, Forces & System of Forces, Composition, Resolution & resultant of Forces, Laws of Forces, Lami's Theorem, Moment & Couples, Varignon's Theorem, Free Body Diagram, Centre of Gravity of a Lamina, Centroids of various Geometric Shapes, Moment of Inertia, Radius of Gyration, Parallel and Perpendicular Axis Theorem.

Frames and Trusses: Introduction, Perfect Frame, Redundant Frame, Reactions of Supports, Plane Trusses, Space Trusses, Method of Joints, Method of Section, Graphical Method- Maxwell Diagram.

Section-B

Simple Stresses and Strains: Stress & strain; Types of stresses and strains Elastic limit; Hooks law; Stress – strain diagram for ductile and brittle material, Factor of safety; Poisson's ratio; Elastic constants; Young's modulus, Shear modulus & Bulk modulus. Relationship between elastic constants. Thermal Stress & Strain.

Shear Force and Bending Moment: Concept of beams - statically determinate and indeterminate beams, Concept and definition of shear force and bending moment, Sign conventions, Types of load – concentrated, uniformly distributed, uniformly varying, Types of beams: Cantilever beam, simply supported beam, overhanging beam; Shear force and bending moment diagrams for the above beams subjected to different loadings and couples. Point of contra flexure, Relationship between load, Shear force and bending moment.

Section-C

Bending Stresses in Beams: Bending Stresses in Beams with derivation of Bending equation and its application to beams of circular, rectangular I & T Section, Composite beams.

Shearing Stresses in Beams: Shearing stress at a section in a loaded beam, Shear stress distribution over different sections.

Section-D

Torsion of Circular Shaft: Introduction, Theory of Pure torsion - Derivation of torsion equation, assumptions made in theory of pure torsion, Maximum torque transmitted by Solid and hollow shafts, Polar modulus, Torsion rigidity, Power transmitted by a shaft, Comparison of hollow and solid shaft subjected to pure torsion,Close coiled helical spring subjected to axial load and torque.

Introduction to Friction: Definition, Principles of friction, Friction between solid bodies, Coefficient of friction, Kinetic friction force, Definition & Determination of angle of friction, Laws of friction , Procedure for friction analysis, Equilibrium of rigid bodies subjected to frictional force of resistance, Friction at the ends of ladder, Wedge friction, Remedial measures in overcoming friction.

TEXT BOOKS:

1. Engineering Mechanics-Nelson, McGraw Hill
2. Engineering Mechanics: Statics, Meriam, JohnWiley

REFERENCE BOOKS:

1. Mechanics of Materials-E.J. Hearn, Elsevier
2. Engineering Mechanics-Bhavikatti, New Age International
3. Engineering Mechanics- JagatBabu, Pearson
4. Engineering Mechanics, P.N. Chandramouli, PHI Learning Private Limited.
5. Engineering Mechanics, V. Jayakumar & M. Kumar, PHI Learning Private Limited.

Engineering Physics Lab (NS-105(P))

Course Code	**NS-105(P)**		**L-0, T-0, P-2**
Name of the Course	**Engineering Physics Lab**		
Lectures to be Delivered	**26 hours of Lab. work (2 hrs. per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%, Lab Record 25% Viva/ Hands on 25%, Attendance 20%**		**Max Marks: 25**

Instructions for paper setter / candidates

Laboratory examination will consist of two parts:

Performing a practical exercises assigned by the examiner.

Viva-voce examination

Viva-voce examination will be related to the practicals performed / project executed by the candidate related to the paper during the course of the semester.

List of Experiments

2. To find the refractive index of a prism by using spectrometer.
3. To find the wavelength of sodium light by Newton's rings experiment.
4. To find the wavelength of sodium light by Michelson interferometer.
5. To study the laser beam characterstics like, wavelength using diffraction grating aperture & divergence.
6. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
7. To find the value of e/m for electrons by Helical method.
8. To compare the capacitances of two capacitors by De'sauty Bridge.
9. To find the value of Planck's constant by using a photoelectric cell.
10. To calculate the hysteresis loss by tracing a B-H curve for a given sample
11. To determine the Hall co-efficient
12. To determine the band gap of an intrinsic semiconductor by four probe method.
13. To find the velocity of ultrasound in liquid.
14. To find out polarizability of a dielectric substance.
15. To determine the numerical Aperture of an optical fibre.
16. To determine the attenuation & propagation losses in optical fibres.

Note: Each student is required to perform at least ten experiments.

Books:

1. Practical Physics-S.L.Gupta&V.Kumar.
2. Advanced Practical Physics Vol. I & II – S.P. Singh

Communication & Professional Skills Lab-I (HS-102(P))

Course Code	**HS-102 (P)**	**Credits-2**	**L-0, T-0, P-2**	
Lectures to be Delivered	**26 hours of Lab. work (2 hrs. per week)**			
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**	
Continuous Assessment	**Lab work 30%**	**Lab Record 25%**		**Max Marks: 25**
	Viva/ Hands on 25%	**Attendance 20%**		

Instructions for paper setter / candidates:

Laboratory examination will consist of two parts:

(i) Performing a practical exercises assigned by the examiner .
(ii) Viva-voce examination

Note: Each practical should be performed twice for effectiveness.

List of Practicals:

1. Word processing a document.
2. Power point presentations.
3. Resume / Biodata preparation
4. Report writing.
5. Preparing notice, agenda and minutes of meeting.
6. Preparation of Quotation and tender document
7. Note making based reading comprehension
8. Précis Writing

Recommended books:

1. English Conversation Practice by Grant Taylor
2. Business correspondence and Report Writing: by R. C. Sharma & Krishna Mohan
3. Chrissie Wright (Ed.); Handbook of Practical Communication Skills; JAICO Books.
4. Veena Kumar, The Sounds of English, Makaav Educational Software, New Delhi.

Computer Programming Laboratory (BE-104(P))

Course Code	**BE-104 (P)**		**L-0, T-0, P-2**
Name of the Course	**Computer Programming Laboratory**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

1. Write a Program to find the sum, difference, product and quotient of two integers.
2. Write a program C++ Program to output an integer, a floating point number and a character.
3. Write a program to switch between different cases.
4. Write a program to count the number of words and characters in a sentence.
5. Program to find the roots of a quadratic equation.
6.
   - Create a class rational which represent a numerical value by two double values numerator and Denominator include the following public members functions
   - Constructor with no argument(default)
   - Constructor with two arguments
   - Void reduce ()that reduce the rational number by eliminating the highest common factor between the numerator and the denominator
   - Overload + operator to add two rational numbers
   - Overload >> operator to enable input through cin.
   - Overload << operator to enable input through cout.

7. Write a program to convert days into years and weeks.
8. Write a program to convert temperatures from Celsius to Fahrenheit and vice versa.
9. Write a program to find the sum of either of the diagonals of a 4 x 4 matrix.
10. Write a program to enter a sentence and output the number of uppercase & lowercase consonants, uppercase & lowercase vowels in sentence.
11. Write a program to enter 10 integers in a single-dimension array and then print out the array in ascending order.
12. Write a program to find the sum of each row & column of a matrix of size n x m and if matrix is square, find the sum of the diagonals also.
13. Write a program to display fibonacci series upto n terms.
14. Write a program for payroll system using inheritance.
15. To calculate the total mark of a student using the concept of virtual base class.
16. Program for Write File Operation Using C++ Programming.
17. Write a program that creates a binary file by reading the data for the student for the terminal .The data of each student consist of roll number, name (a string of thirty or lesser number of characters) and marks.
18. Write a program to read a number and display its square, square root, cube and cube root. Use a virtual function to display any one of the above.
19. Write a program to read two matrix and find their product use operator overloading so that the statement for multiplying the matrix may be written as Z=x*y where x,y,z are matrices.

WORKSHOP PRACTICE-I (WS-101)

Course Code	**WS– 101**	**L-0, T-0, P-3**	
Name of the Course	**Workshop Practice –I**		
Lectures to be delivered	**39 hours of Lab sessions in each semester**		
Semester End Examination	**Max. Marks: 25**		**Min. Pass Marks: 10**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%**		**Max. Marks: 25**

INSTRUCTIONS:

Laboratory examination will consist of two parts:
(i) Performing a practical exercises assigned by the examiner .
(ii) Viva-voce examination
Viva-voce examination will be related to the practicals performed / project executed by the candidate related to the paper during the course of the semester.

List of Experiments: -

Fitting Shop: -
Introduction to the tools used in Fitting Shop and various processes in Fitting shop.
1. To make a square piece of mild steel.
2. To make V-matching joint of mild steel.
3. To make a V-notch.

Machine Shop: -
Introduction to various machine tools and machine parts, such as Lathes, drilling machine, grinders etc. Cutting tools and operations.
1. Facing and turning on mild steel rod on Lathe Machine.
2. To make a groove on lathe machine.
3. Taper turning operation on Lathe Machine.

Carpentry and Pattern making Shop: -
Carpentry and Pattern Making Various types of timber and practice boards, defects in timber, seasoning of wood, tools, operations and joints. Introduction to the tools used in carpentry shop.
1. To make the 'T' lap joint.
2. To make 'T' Dove-tail joint.
3. To make Mortise &Tennon joint.

Welding Shop: -
Introduction to different welding methods, welding equipment, electrodes, welding joints, awareness of welding defects.

1. To make a lap joint.
2. To make a T joint.
3. To make a V-butt joint.

Smithy and Forging: -

Introduction to forging tools, equipments, and operations, Forgability of metals.

1. To make a ring of mild steel by cold forging process.
2. To make S-hook by hot forging process.
3. To make chisel by hot forging process.

Foundry Shop: -

Introduction to moulding materials, moulds, use of cores, melting furnaces, tools and equipment used in Foundry.

1. Make a single piece pattern mould.
2. To make spilt pattern mould.
3. To make mould and core and assemble it.

Electrical and Electronics Shop: -

Demonstration of tools, Introduction to electric wiring, Exercises preparation of PCBs, involving soldering of electrical & electronic application.

1. Fault rectification, disassembly and assembly of (any two) electrical appliances viz. electric iron, electric mixer, ceiling and table fan, tube light, blower and water heater.
2. Demonstration and use of flowing electronic instruments: multimeter, voltmeter, ammeter, energy meter, CRO.

Suggested Reading: -

1. Workshop Technology by Chapman.
2. Manufacturing Processes by Begman.
3. Manufacturing Materials and processes by JS Campbell.
4. Workshop Practice-I, Mechanical Workshop Practice, 2nd Edition by John, PHI Learning Private Limited.

SEMESTER III
HUMAN VALUES AND PROFESSIONAL ETHICS-III

Course Code	**HS-203**	**L-02, T-0, P-02**	
Name of Course	**Human Values and Professional Ethics**		
Lectures to be delivered	**52 (L-26, P-26 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continuous Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of six sections A, B, C, D, E & F. Section F will be compulsory, it will consist of a single question with 10-15 subparts of short answer type, which will cover the entire syllabus. Section A, B, C, D & E will have two questions from the respective sections of the syllabus. Each section will have a weightage of 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt six questions in all selecting one question from each of the sections A, B, C, D & E of the question paper and all the subparts of the questions in Section E.

OBJECTIVES:

a. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

b. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.

c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much needed orientation input in Value Education to the young enquiring minds.

COURSE METHODOLOGY:

- The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence.
- It is free from any dogma or value prescriptions.
- It is a process of self-investigation and self-exploration, and not of giving sermons.
- Whatever is found as truth or reality is stated as proposal and the students are facilitated to verify it in their own right based on their Natural Acceptance and Experiential Validation.
- This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and within the student himself/herself finally.
- This self-exploration also enables them to evaluate their pre-conditionings and present beliefs.

Content

SECTION A: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in **harmony** at various levels

SECTION B: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure *Sanyam* and *Swasthya*

- Practice Exercises and Case Studies will be taken up in Practice Sessions.

SECTION C: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding harmony in the Family- the basic unit of human interaction
14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;
    Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship
15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals
18. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*- from family to world family!
    - Practice Exercises and Case Studies will be taken up in Practice Sessions.

SECTION D: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence
    - Practice Exercises and Case Studies will be taken up in Practice Sessions.

SECTION E: Implications of the above Holistic Understanding of Harmony on Professional Ethics

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order,
b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems,
c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

27. Case studies of typical holistic technologies, management models and production systems
28. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations

TEXT BOOK:

1. R R Gaur, R Sangal, G P Bhagaria, 2009, *A Foundation Course in Value Education*.

REFERENCE BOOKS:

1. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
7. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers ,* Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd.
11. Values and Ethics in Business & Professional, Samita Manna & Suparna Chakraborti, PHI Learning Private Limited.

RELEVANT CDS, MOVIES, DOCUMENTARIES & OTHER LITERATURE:

1. Value Education website, *http://www.uptu.ac.in*
2. Story of Stuff, *http://www.storyofstuff.com*
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology – the Untold Story*

SEMESTER III

ENGINEERING MATHEMATICS-III (NS-206)

Course Code	**NS-206**	**L-03, T-01, P-0**	
Name of Course	**Engineering Mathematics-III**		
Lectures to be delivered	**52 (L-39, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

Section-A

1. PARTIAL DIFFERENTIAL EQUATIONS

Formation and solutions of partial differential equations, Lagrange's linear equation of the first order, non linear equations of first order, charpit method, Homogenous linear partial differential equation with constant coefficients, rules for complementary function and particular integral, non-homogenous linear partial differential equations, Method of separation of variables, Solution of wave equations, Heat flow equations, Laplace's equations and their applications to engineering problems.

Section-B

2. SPECIAL FUNCTIONS:

Power series solution of differential equations, Frobenius method, Bessel's equation, Bessel functions of the first and second kind, Recurrence relations of Bessel functions, Generating functions, Orthogonality of Bessel functions, Legendre's equation, Legendre polynomial, Recurrence relations of Legendre's functions, Rodrigue's formula, Orthogonality of Legendre polynomials, Error function and its properties.

Section-C

3. INTEGRAL TRANSFORMS

Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Laplace transform of Bessel functions and Error function, Dirac-delta Function, Heaviside's Unit Function, Applications to linear simultaneous differential equations. Fourier Integral, Fourier Transform, Fourier sine and cosine transforms, finite Fourier transform, Convolution theorem for Fourier Transform and Parseval's Identity for Fourier Transform.

Section-D

4. FUNCTIONS OF COMPLEX VARIABLE

Limit and derivative of complex functions, Cauchy-Riemann equations, Analytic functions, Entire functions and its applications, Conformal mapping and standard transformations, Complex integration, Cauchy's theorem and Cauchy's integral formula (without proof), Series of complex terms, Taylor's series and Laurent's series (without proof), Zeros of analytic functions, isolated singularity, removable singularity, Poles, essential singularity, Residue, Residue theorem and their applications

TEXT BOOKS

1. Advanced Engineering Mathematics: by Erwin Kreyszig . John Wiley and Sons, NC, New York.
2. Partial Differential Equation for Engineers and Scientists: by J.N. Sharma and Kehar Singh Narosa Publishing House, New Delhi/ Alpha Science Int. Ltd, UK.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.
4. Complex Variables Theory and Applications: by HS Kasana, PHI Learning Private Limited New Delhi, (2008).

REFERENCE BOOKS

1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
2. Elements of Partial Differential Equations: by Ian N. Sneddon, McGraw-Hill, Singapore.
3. Differential & Integral Calculus: by N. Piskunov, MIR Publications.
4. Calculus and Analytic Geometry, by Thomes, G.B, Finney, R.L. Ninth Edition, Peason Education.
5. Advanced Engineering Mathematics,by Peter. V. O. Nil, Wordsworth Publishing Company.
6. Advanced Engineering Mathematics, by Jain, R.K and Lyengar, S.R.K., Narosa Publishing Company.
7. Higher Engineering Mathematics, by Grewal, B.S., Khanna Publishers, New Delhi.
8. Engineering Mathematics, by Taneja, H.C., Volume-I & Volume-II, I.K. Publisher.
9. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.

SEMESTER III
TRANSMISSION & DISTRIBUTION OF ELECTRICAL POWER

Course Code	**EE–211**	**L-03, T-01, P-0**	
Name of Course	**TRANSMISSION & DISTRIBUTION OF ELECTRICAL POWER**		
Lectures to be delivered	**52 (L-39, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION A

INTRODUCTION: Structure of a power system, indoor and outdoor substations, equipment for substation layout, auxiliary supply.

DISTRIBUTION SYSTEMS: Radial, ring mains and network distribution system, comparison of various types of ac and dc systems.

SECTION B

TRANSMISSION LINES: Introduction: inductance of a conductor due to internal flux and external flux, inductance of a single phase two-wire line, inductance of three phase line, capacitance of three phase line, charging current due to capacitance, skin effect, Ferranti effect, proximity effect.

PERFORMANCE OF LINES: Models of short, medium and long transmission lines, performance of transmission lines, circle diagram, capacity of synchronous condenser, tuned lines, voltage control.

SECTION C

MECHANICAL DESIGN: Sag and stress calculations, effect of ice and wind, string chart, line supports, conductor material, dampers.

INSULATORS: Types, insulating materials, voltage distribution over insulator string, equalizer ring, configuration of insulators for EHV AC & HVDC transmission systems, post insulators, insulator failures, testing of the insulators.

SECTION D

CABLES: Types of cables, construction of cables, grading of cables, capacitance, ratings, power factor in cables, thermal characteristics and applications.

CORONA: Phenomenon, critical voltage, power loss, reduction in losses& radio-interference. HVDCTransmission- types of links, advantages and limitations, corona in HVDC lines.

TEXT BOOKS

1. Power System Engg: I.J.Nagrath and D.PKothari (TMH)
2. A Course in Electrical Power: Gupta, Soni & Bhatnagar (Dhanpat Rai & Sons).

REFERENCE BOOKS:

1. Power system: Aqshaf Hussain, Dhanpat Rai, Delhi
2. Elements of power system analysis: W.D.Stevenson (MGH)
3. Electric Power: S.L. UppaI (Khanna Pub.)
4. Electrical power: J.B.Gupta (S.K.Kataria & Sons).
5. Power System Engineering: B. R. Gupta.

SEMESTER III
CIRCUIT THEORY

Course Code	**EE–212**	**L-03, T-01, P-0**	
Name of Course	**CIRCUIT THEORY**		
Lectures to be delivered	**52 (L-39, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION A

Introduction: Laplace transform, concept of independent and dependent sources, analysis of special signal waveforms, duality of networks.

Network theorems: Superposition and Reciprocity theorem, Thevenin's and Norton's theorem, Millman's theorem, maximum power transfer theorem, compensation, Tellegan's theorem, analysis of circuits using theorems.

SECTION B

Analysis of network using Graph Theory: Graph for given network, classification of graph and sub graphs, incidence , tie set and cut set matrices, terminology used in Network Graph, properties of tree in a graph, variable solution of network using graph theory and matrix from the concept of network function

Network Synthesis: Driving point functions, P.R functions , properties of P.R functions, Hurwitz polynomials, properties of Hurwitz polynomial functions,

SECTION C

Transient Analysis of Networks: Network elements, Transient response of R-L, R-C, R-L-C for DC and sinusoidal excitation, Initial condition, Solution using differential equation approach and Laplace transform method.

Coupled Circuit: Self inductance, Coefficient of coupling, dot convention analysis of coupled circuits, analysis of single tuned & double tuned circuits.

SECTION D

Two-Port Network: Introduction, different parameters and relationship between different parameters, inter-connections of two port networks, open circuit and short-circuit impedances and ABCD constants, image impedance, image parameters.

TEXT BOOKS:

1. Network and Systems by D. Roy Chowdhury, "*Wiley Eastern*".
2. Engineering Circuit Analysis by W. H. Hayt and J.E. Kemmerly, "*McGraw Hill*".

REFERENCE BOOKS:

1. A Course in Electrical Circuit Analysis by Soni and Gupta, "*Dhanpat Rai & Sons*".
2. Modern Network Synthesis by M. E. Van Vallkenburg, "*Wiley Eastern*".
3. Electronic devices and Circuit theory by R.L. Boylestad and L. Nashelesky, *"PHI"*

SEMESTER III
ELECTRICAL ENGG. MATERIALS & APPLICATIONS

Course Code	**EE–213**	**L-03, T-01, P-0**	
Name of Course	**ELECTRICAL ENGG. MATERIALS & APPLICATIONS**		
Lectures to be delivered	**52 (L-39, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION A

CONDUCTING MATERIALS: Introduction, atomic theory, Inter atomic Bonds, Resistivity and factors Affecting Resistivity, classification of conducting materials into low-resistivity and high resistivity materials. Main features and their applications. (Copper, aluminium, steel, brass, bronze,Tungsten, carbon, platinum, mercury). Superconductivity, super-conducting materials and theirapplications.

SECTION B

INSULATING MATERIALS: Introduction, General properties of insulating materials, Electrical properties, Visual properties, Mechanical properties, Thermal properties, Chemical properties,Classification-introduction, Classification of insulating materials on the basis of physical and chemical structure and their applications, Fibrous materials (Wood, Paper and card board, insulating textiles) impregnated Fibrous materials (impregnated insulating paper, varnished or impregnated textiles), non-resinous materials (bitumens, waxes).

Insulating liquids: main features and their applications. (Mineral insulating oils)

Ceramics: main features and their applications. (Porcelain, alumina, titanates, steatite) mica, asbestos, glass, natural and synthetic rubbers, insulating resins, laminates and adhesives.

Insulating gases: main features and their applications: nitrogen, hydrogen, sulphurhexafloride.

SECTION C

MAGNETIC MATERIALS: Permeability & Magnetic susceptibility, magnetic moment, Magnetization. Types of magnetic materials (diamagnetism, Paramagnetism, ferromagnetism), Magnetisation curve, eddy current & Hysteresis losses, curie point, Magnetostriction, applications, soft and hard materials:(pure iron, iron-silicon alloys, grain oriented sheet steel, magnetic anisotropy, annealing, nickel iron alloys, soft ferrites, carbon steel, tungsten steel, cobalt steel, alnico, hard ferrites).

SECTION D

SEMICONDUCTORS: introduction, electron energy and energy band theory, excitation of atoms,N-type materials, P-type materials, (Boron, Carbon, Silicon, Germanium, Phosphorus, Arsenic,Antimony, Sulphur, Selenium, Tellurium, Iodine). Si and Ge as semi-conducting materials,application of semiconductor materials: Rectifiers (Germanium and Silicon rectifiers, Copper-oxideAnd Selenium Rectifiers). Temperature-sensitive resistors or thermistors, Photoconductive cells,Photovoltaic cell, Transistor, Hall Effect Generators, Strain Gauges

TEXT BOOKS

1. Electrical Engg. Materials: K. B. Raina, S. K. Bhattacharya, Tilak Joneja, TTTI Chandigarh: Katson Pub. House New Delhi
2. Electrical Engineering Materials: A.J. Dekker; PHI.:

SEMESTER III
DIGITAL ELECTRONICS

Course Code	**EC–211**	**L-03, T-01, P-0**	
Name of Course	**DIGITAL ELECTRONICS**		
Lectures to be delivered	**52 (L-39, T-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION A

Number system & codes: Introduction to Number system: Binary, Octal, Hexadecimal number systems and their inter-conversion, Binary Arithmetic (Addition, Subtraction, Multiplication and Division),Floating Point numbers & Arithmetic Diminished radix and radix compliments, BCD codes, 8421 code, Excess-3 code, Gray code, Error detection and correction: Parity code Hamming code.

Logic Gates, Boolean Algebra & Simplification Techniques: Positive & negative Logic; Logic Gates Tristate Logic gates Schmitt gates ; special output gates; Fan out of logic gates; buffer & transceivers ; IEEE/ANSI standards symbols Introduction to Boolean algebra ; Postulates of Boolean Algebra; Theorems of Boolean algebra

SECTION – B

Boolean Algebra & Simplification Techniques: Sum of products and Product of Sums Simplification, NAND and NOR implementation, incompletely specified functions, Ex-OR functions, The map method, Two, Three, Four and Five variable maps, The tabulation method, Determination of Prime implicants, Selection of Essential Prime implicants,

Logic Families: Classsification of digital IC's ; Significance & types ; Characteristics Parameters ; TTL Logic ;ECL CMOS Logic Family; NMOS & PMOS Logic; Interfacing of different logic families

SECTION – C

Combinational Logic Circuits: Implementing combinational logic ;Arithmetic circuits: half Adder ,full adder ,half subtractor full subtract; BCD Adder; Multiplexer; Encoder; Demultiplexer & Decoder

Flip Flops: Introduction, S-R Flip -flops, Level & edge Triggered flip flops; JK flip-flop, D flip-flop, T flip-flop, master slave flip-flop , Flip Flop timing parameters & application ;

Counters: Ripple counter; Synchronous Counter; Modulus of a counter; Binary ripple counter; UP & down; Decade & binary counter ; Shift register ; shift register counter

SECTION – D

Data conversions Circuits: Digital to analogue Converter(Simple Resistive divider network ; binary lader network); D/A converter: specification &Types ;A/D Converter: Specification & Types

Semiconductor Memories: Introduction, Memory organization, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories. Content addressable memories, Programmable logic arrays, Charged-Coupled device memory

TEXT BOOKS:

1. Digital electronics (Principle & Integrated circuits)- Anil K maini- Wiley India edition
2. M. Morris Mano, Digital Design, Prentice Hall of India.

REFERENCE BOOKS:

1. Thomas Downs and Mark F Schulz, Logic Design with Pascal, Van Nostrand Reinhold.
2. Digital principle and applications Malvino and Leach- (TMH)

SEMESTER III
TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER – LAB

\\Course Code	**EE – 211(P)**		**L-0, T-0, P-2**
Name of the Course	**Transmission & Distribution of Electric Power Lab**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30% Lab Record 25%, Viva 25% Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To find out A, B, C, D parameters, hybrid parameters and image parameters of a given transmission line model.
2. To study the performance of a long transmission line under no load condition and under light load condition.
3. To study the performance of a long transmission line under load at different power factors.
4. Visit to substation and preparing layout of various equipments in the substation.
5. To study the performance characteristics of a typical DC distribution system (Radial Configuration)
6. To study the performance characteristics of a typical DC distribution system (Ring main Configuration)
7. To find out voltage distribution across the string of insulators without guard ring.
8. To find out voltage distribution across the string of insulators with guard ring.
9. To plot equipotential lines of paper model of single layer cable.
10. To plot equipotential lines of paper model of multi layer cable.
11. To measure the insulation resistance of cable.

Note: At least 10 experiments should be performed from above list.

SEMESTER III
CIRCUIT THEORY LAB

Course Code	**EE – 212(P)**		**L-0, T-0, P-2**
Name of the Course	**CIRCUIT THEORY LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related
to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To study and verify Thevenin and Norton theorem
2. To study and verify superposition and reciprocity theorem
3. To study and verify Milliman and Maximum power theorem
4. To study and verify Tellegan theorem
5. To study frequency response of series RLC circuit and determine resonance frequency and Q factor for various values of R,L,C
6. To study frequency response of parallel RLC circuit and determine resonance frequency and Q factor for various values of R,L,C
7. To design a two-port network using bread board and also find its ABCD parameters

Note: At least 6 experiments should be performed from above list.

SEMESTER III
DIGITAL ELECTRONICS LAB

Course Code	**EC – 211(P)**		**L-0, T-0, P-2**
Name of the Course	**DIGITAL ELECTRONICS LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related
to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To verify the truth table of logic gates realize AND, OR, NOT gates
2. To realize AND, OR gates using diodes and resistors
3. Implementation of X-OR and X-NOR using NAND and NOR
4. Design of adder, subtractor, BCD adder using IC 7483
5. Implementation of logic equations using MUX, DEMUX
6. Design of encoders and decoders
7. Conversion of flip flops
8. Design of counters and registers
9. Application of logic design- sequence detector
10. Design a half/full adder circuit using FF for 2 bits
11. Design a half/full sub tractor circuit using FF for 2 bits
12. Design BCD to seven-segment display using 7447 IC

Note: At least 8 experiments should be performed from above list.

SEMESTER III
Communication & Professional Skills Lab-II

Course Code	**HS-202(P)**		**L-0, T-0, P-2**
Name of the Course	**Communication & Professional Skills Lab-II**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30% Lab Record 25%, Viva 25% Attendance 20%**		**Max Marks: 25**

Instructions for paper setter / candidates:

Laboratory examination will consist of two parts:

(iii) Performing a practical exercises assigned by the examiner (25 marks).
(iv) Viva-voce examination (25 marks)

Note: Each practical should be performed twice for effectiveness.

List of Practical:

1. Phonetics: Organs of speech, speech sounds, symbols, articulation of speech sounds- stress and intonation.
2. SWOT analysis (Personal / Organisation)
3. Group discussion
4. Debate
5. Vocabulary improvement programs
6. Technical write up based on critical thinking (On subject allocated by coordinator)
7. Telephonic etiquettes: Preparing, Controlling and Follow up.

RECOMMENDED BOOKS:

1. Developing Communication Skills: by Krishan Mohan & Meera Bannerji
2. Group Discussions by Sudha Publications And Ramesh Publishing House, New Delhi
3. Vocabulary Improvement: Words Made Easy: by Diana Bonet
4. Word Power Made Easy: by Norman Lewis

SEMESTER – IV
ENGINEERING ECONOMICS (HS-201)

Course Code	**HS-201**	L-3, T-1, P-0	
Name of the Course	**Engineering Economics**		
Lectures to be delivered	**39 (1 Hr Each) (L= 39 for each semester)**		
Semester End Examination	**Max. Time =3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

Section-A

Economics: Definition, nature and scope of economics, need &significance of economics in Engineering, Economic Systems- Meaning of capitalism, socialism and mixed economy

Demand: Meaning, determinants of demand, demand curve, law of demand, exception to the law of demand, increase &decrease in demand, contraction &extension of demand, Elasticity of demand, Methods of measuring Elasticity of demand

Supply: Law of supply, extension &contraction of supply, increase & decrease in Supply, Elasticity of supply

Section-B

Cost of Production: Concept, types, Relation between average & marginal cost.

Theory of Production: Laws of returns- Law of variable proportions and law of returns to Scale, Break Even Analysis.

Price & Output Determination: Price determination under perfect competition, monopoly, monopolistic competition &oligopoly.

Section-C

Monetary policy- Meaning, objectives, methods, Fiscal policy- Meaning &Objectives of fiscal policy in a developing country like India, Functions of Reserve Bank of India and commercial banks.

Economics & Business Environment- Business/Trade Cycles- Meaning, Characteristics & classification, Inflation Effect, Foreign capital &economic development, Engineering Economics Analysis, Economics Analysis in the public and regulated sectors.

Section D

Indian Economy: - Characteristics of Indian economy, Planning in India, Development &Growth in India. Overall Economic policy since independence, Input & output analysis, Problem of unemployment in India. Concept of sustainable development &inclusive growth in India. Policy of globalizations, liberisation & privatization. Analysis of state &union budgets.

TEXT BOOKS:

1. Modern Micro Economics by Koutsoyannisa, MC Millen
2. Principles of Engineering Economics Analysis by John A. White, Kenneth E. Case and David B. Pratt Wiley India

REFERENCE BOOKS:

1. Business Economics by K. P. M. Sundharam, Sultan Chand &Sons
2. Elementary Economics Theory by K.K Dewett & J. D. Verma, S.Chand Publication

SEMESTER – IV

NUMERICAL METHODS FOR ENGINEERS (NS-207)

Course Code	**NS-207**	**L-03, T-01, P-0**	
Name of Course	**Numerical Methods for Engineers**		
Lectures to be delivered	**52 (L-39, P-13 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continuous Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION –A

SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Bisection method, Method of false position, secant method, Iteration method, Newton-Raphson method and Generalized Newton-Raphson method, Rate of convergence and condition of convergence, solution of simultaneous equations by Iteration method and Newton-Raphson method

SOLUTION OF SIMULTANEOUS ALGEBRAIC EQUATIONS: Partial and Complete Pivoting, Gauss Elimination method, Gauss Jordan method, Jacobi's method, Gauss-Seidal method, Relaxation method and LU-decomposition method.

SECTION-B

FINITE DIFFERENCE AND INTERPOLATION: Errors and approximation analysis, Interpolation, Various difference operators and relation between them, Newton's forward and backward interpolation formulae, Central difference Interpolation formula, Gauss's forward and backward interpolation formulae, Stirling formula, Bessel formula, Lagrange's interpolation formula of unequal intervals, Newton's divided difference formulae.

SECTION-C

NUMERICAL DIFFERENTIATION AND INTEGRATION: Numerical differentiation: Derivatives using Newton forward, backward and central difference formulas, Derivatives using Gauss forward and backward formulas, Derivatives using Bessel formula, Derivatives using Newton divided difference formulas, Maxima and minima of tabulated functions.

NUMERICAL INTEGRATION: Newton-Cotes Quadrature formula, Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules, Boole's and Weddle's rules, Errors and accuracy of these formulae (Trapezoidal rule, Simpson's $1/3^{rd}$ rule) Romberg's integration.

SECTION-D

NUMERICAL SOLUTIONS OF ORDINARY EQUATIONS: Picard method, Taylor's series method, Euler's method, Runge's method, Runge-Kutta method, Predictor- Corrector Methods: Milne's method and Adams-Bashforth method.

NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL: Finite difference approximations of partial derivatives, solution of Laplace equation (Standard five-point formula and Diagonal five-point formula), Solution of Poisson equation.

TEXT BOOKS:

1. Numerical methods for Scientific & Engg. Computations: M. K. Jain, S. R. K. Iyengar & R. K. Jain; Wiley Eastern Ltd.
2. Introductory Methods of Numerical Analysis Engineers & Sciences: S. S. Sastry, PHI Learning Private Limited New Delhi, (2009).

REFERENCE BOOKS:

1. Numerical Methods in Engineers & Sciences : J.N Sharma : Narosa Publishers.
2. Numerical Methods in Engg. & Sciences : B.S.Grewal : Khanna Publishers.
3. Computer Oriented Numerical methods: U. Rajaraman Orebtuce; Hall of India.
4. Introduction to Numerical Analysis: C. E. Froberg; Addison Wesley.

SEMESTER – IV
ELECTRICAL MACHINES – I

Course Code	**EE – 221**	L-3, T-1, P-0	
Name of the Course	**ELECTRICAL MACHINES – I**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION –A

Principle of Transformer operation, construction, EMF equation, Ideal transformer, no load & on load operation, phasor diagram and equivalent circuit, practical transformer, , voltage regulation, ,rating of transformers, Transformers losses and efficiency, condition for maximum efficiency, per unit transformer values, all day efficiency, tesing of transformers, distribution transformers, power transformers, application of transformers.

SECTION-B

Single phase auto transformer, comparison of characteristics of auto transformers and two winding transformers, conversion of a two winding transformer to an auto transformer, advantages & disadvantages of auto transformer, applications of auto transformer. Three phase transformer, advantages of three phase unit transformer, three phase transformer construction, three phase transformer groups, three phase transformer connections, factors affecting the choice of connections, delta- delta connection, star-star connection, star- delta connection, delta-star connection, open delta connection, Scott three phase/ two phase connection, relationship between input and output currents, Advantages, disadvantages and applications(star-star, delta-delta, star-delta, delta-star, open-delta, Scott connections) of these type of connections, voltage regulation. Polarity of the transformers, parallel operation, single-phase transformers and 3-phase transformers in parallel, Construction of current transformers and voltage transformers, transformer cooling.

SECTION-C

Dc generator construction , basic structure, methods of excitation, equivalent circuit of dc machine armature, types of dc machine, emf equation of dc machine, lap & wave winding, Armature reaction in DC Generators, commutation, methods of improving commutation, Magnetization and operating characteristics of generators

SECTION-D

Direct current motors: working principle, counter emf, equivalent circuit of a dc motor armature, torque, types of dc motor, armature reaction in dc motor and interpoles, operating characteristics of shunt, series & compound motors, speed control and starting of dc motors ,types of starters, losses in dc motors, Efficiency, testing, and application of dc machines.

TEXT BOOKS

1. Electrical Machines, AshfaqHussain, DhanpatRai, Delhi
2. Electrical Machinery, P. S.Bhimbra, Khanna Publishers Delhi

REFERENCE BOOKS

1. Electric Machines: I.J.Nagrath and D.P .Kothari, TMH, New Delhi.
2. Performance & Design of D.C. Machines: A.E. Clayton & N.N Hancock; ELBS
3. Electric Machinery, Fitzgerald & Kingsley, MGH.
4. Theory of alternating current machinery, A.S. Langsdorf, TMH.
5. Generalized theory of electrical machine, P. S.Bhimbra, Khanna Publishers Delhi

SEMESTER IV
POWER ELECTRONICS

Course Code	**EE – 222**	L-3, T-1, P-0	
Name of the Course	**POWER ELECTRONICS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

POWER ELECTRONIC DEVICES: Applications of power electronics, power semiconductor devices, power diodes, bipolar junction transistor, power MOSFET, Thyristor & its two transistor model, Triac, Gate turn off thyristor (GTO), insulated gate bipolar transistor (IGBT), comparison of switching power devices, turn on & turn off characteristics of SCR, driver circuits. series and parallel connections: R, RC, and UJT firing circuit; pulse transformer and opto-coupler, commutation techniques.

SECTION-B

AC REGULATORS: Types of regulator, equation of load current, calculation of extinction angle, output voltage equation, harmonics in load voltage, three phase regulator**.**
CONVERTERS : Principle of phase control converter operation, single phase converter single phase dual converter, principle of three phase half wave converters, three phase full converter and dual converter, load voltage waveforms, output voltage equation, continuous and discontinuous modes of operation, effect of source inductance, power factor improvement techniques, forced commutated converters

SECTION-C

INVERTERS: Principle of operation, Basic circuit, 120□□and 180□□conduction schemes, single phase inverter ,Three phase inverter, Brief description of parallel and series inverters, Current source inverters (CSI), voltage source inverter, PWM techniques.

SECTION-D

CHOPPERS: Basic scheme, output voltage control techniques, one, two and four quadrant choppers, step up chopper, voltage commutated chopper, current commutated chopper.

CYCLO CONVERTERS: Basic principle of frequency conversion, types of cyclo converters, non-circulating and circulating types of cyclo-converters.

TEXT BOOKS

1) Power Electronics by M.H Rashid PHI
2) Power Electronics by P. S. Bhimra

REFERENCE BOOKS

1. Power Electronics by P.C.Sen, TMH
2. Power Electronics by H.C Rai, Galgotia
3. Thyristorised Power Controllers by G.K Dubey, etal
4. Power Electronics, Asghar, PHI Learning Private Limited.

SEMESTER IV
SIGNALS AND SYSTEMS

Course Code	**EE – 223**	L-3, T-1, P-0	
Name of the Course	**SIGNALS AND SYSTEMS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION A

Introduction: Continuous time and discrete time signals, periodic signals, energy and power signal, transformer of independent variables, even and odd signals, exponential and sinusoidal signal, unit impulse and unit step functions, interconnections of systems, systems with and without memory, causality, stability, linearity and time invariance.

SECTION B

Linear Time Invariant Systems: Introduction, discrete LTI systems, Convolution continuous time unit impulse response and convolution integral representation of LTI systems, properties of LTI systems, Stability, causal LTI system described by difference equation, singularityfunctions.
Fourier Series representation: Introduction response of LTI systems to complex exponentials, Fourier series representation for continuous time periodic signals, onvergence of Fouier series, properties of continuous time Fourier series, Fourier series representation of discrete time periodic signals, properties of discrete time Fourier series, Fourier series and LTI system, frequency shaping and frequency selective filters, discrete time filters.

SECTION C

Continuous time Fourier Transform: Introduction, representation for a periodic signals, Fourier series representation of a periodic signals, convergence of Fourier transform, Fourier Transform for periodic, properties of continuous time Fourier transform, convolution and multiplication properties systems described by linear constant coefficient different equations.

Discrete time Fourier Transform: Introduction representation for a periodic signals, DTFT, Fourier transform for periodic signals, convergence of the Fourier transform Gibbs phenomenon, properties of discrete time Fourier transform convolution and mortification properties, system described by linear constant coefficient difference equations.

SECTION D

Time and Frequency Characterization of signal and system: Introduction, magnetic and phase representation of Fourier transform, magnitude and phase representation of frequency response of LTI system, Linear and nonlinear phase, group delay, log magnitude plot, time domain and frequency domain aspects of non-ideal filters 1st and 2nd order continuous time and discrete time systems.

Sampling: Introduction, sampling theorem, sampling with zero order hold reconstruction of a signal from its samples, aliasing, sampling of discrete time signals, decimation and interpolation.

TEXT BOOKS:

1. Signals and Systems, Oppenheim, Willsky& Hamid Nawab.

REFERENCE BOOKS

1. Digital Signal Processing, Proakis and Manolakis.
2. Digital Siganl Processing, Sanjit K Mitra.

SEMESTER IV
ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENT

Course Code	**EE – 224**	L-3, T-1, P-0	
Name of the Course	**ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENT**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

UNITS STANDARDS & ERRORS.S.I units, Absolute standards (International, Primary. Secondary & Working Standards), True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments(Accuracy, Precision, Sensitivity, Resolution & threshold).

MEASURING SYSTEM FUNDAMENTALS: Classification of Instruments (Absolute & Secondary Instruments; Indicating, Recording & Integrating instruments; Based upon Principle of operation),Generalized Instrument (Block diagram, description of blocks), three forces in Electromechanical Indicating Instrument (Deflecting, controlling & damping forces), Comparison between gravity & spring controls; Comparison of damping methods & their suitability, bearing supports, pivot-less supports (Simple &tautband),Scale information, Instrument cases (Covers).

SECTION-B

MEASURING INSTRUMENTS: Construction, operating principle, Torque equation, Shape of scale, use as Ammeter or as Voltmeter (Extension of Range), Use on AC/DC or both, Advantages & disadvantages, Errors (Both on AC/DC) of PMMC types, Electrodynamics Type, Moving iron type (attraction, repulsion &combined types),Hot wire type & Induction type, Electrostatic type Instruments.

SECTION-C

WATTMETERS & ENERGY METERS: Construction, operating principle, Torque equation, Shape of scale, Errors, Advantages & Disadvantages of Electrodynamics & Induction type Wattmeters& single phase induction type Energy meter, Compensation & creep in energy meter.

POWER FACTOR & FREQUENCY METERS: Construction, operation, principle, Torque equation, Advantages & disadvantages of Single-phase power factor meters (Electrodynamics & Moving Iron types)& Frequency meters (Electrical Resonance Types, Ferrodynamic& Electrodynamics types)

SECTION-D

LOW & HIGH RESISTANCE MEASUREMENTS: Limitations of Wheat stone bridge; Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megohmbridge & Meggar.

A.C. BRIDGES: General balance=n, Ckt. diagram, Phasor diagram, Advantages, disadvantages, applications of Maxwell's inductance, inductance-capacitance, Hays, Anderson, Owens, De-Sauty's, Schering & Weins bridges, Shielding & earthing.

TEXT BOOKS

1. A Course in Elect. & Electronic Measurement & Instrumentation by A. K Sawhney; Khanna Pub.
2. Electronic Measurement and Measuring technique, W.D. Cooper & A.D. Helfrick.

REFERENCE BOOKS

1. Electronic & Elect. Measurement & Instrumentation by J.B.Gupta; Kataria& Sons.
2. Electrical Measurements by E.W. Golding
3. Measuring Systems by E.O. Doeblin; TMH.
4. Electrical & Electronics Measurements, Banerjee, PHI Learning Private Limited.

SEMESTER – IV
ELECTRICAL MACHINE – I LAB

Course Code	**EE – 221(P)**		**L-0, T-0, P-2**
Name of the Course	**ELECTRICAL MACHINE – I LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30% Lab Record 25%, Viva 25% Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related
to the paper during the course of the semester.

LIST OF EXPERIMENTS

SECTION A

1. To find turns ratio & polarity of single-phase transformer.
2. To perform open & short circuit tests on single-phase transformer.
3. To perform Sumpner's (Back to Back) test on two identical transformers.
4. To separate the iron losses occurring in single-phase transformer into its components.
5. Parallel operation of two single-phase transformers & to study the load shared by each transformer.
6. To convert three phase to 2-phase By Scott-connection of transformers.

SECTION B

1. To plot the magnetizing characteristics of a dc generator running at rated speed.
2. To obtain and plot the external characteristics of a dc shunt generators & to deduce the internal characteristics from the above.
3. To perform load test on DC shunt generator.
4. Speed control of DC shunt motor.
5. Swinburne's tests of DC shunt motor.
6. To separate the constant losses of DC Machine into their components.
7. Parallel operations of dc generators
8. To obtain and plot the characteristics of DC series motor.
9. To perform load test on DC series motor.
10. To perform the Hopkinson's test on two identical DC machines and to determine the efficiency of motor and generator at various loads.

NOTE: At least 10 experiment to be performed in the semester from the above list.

BOOK

Experimentation and viva voce on electrical machines by Dr. V. N. Mittle&A.Mittal.Standard Publications.

SEMESTER IV
POWER ELECTRONICS LAB

Course Code	**EE – 222(P)**		**L-0, T-0, P-2**
Name of the Course	**POWER ELECTRONICS LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)
Viva-voce examination will be related to the practicals performed/projects executed by the candidate related
to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To study Steady-state characteristics of SCR by plotting graph between voltage and current of Thyristers.

2. To Study R and RC Triggering Circuit for SCR.

3. To study UJT as Relaxation Oscillator.

4. To study SCR Half Wave and Full Wave Bridge Controlled Rectifier-Output characteristics.

5. To study 1-Phase Full Wave Bridge Controlled Rectifier using SCR and UJT with R and R-L Load and observe its input/output characteristics with and without free wheeling (commutating) diode.

6. To study three Phase Full-Wave Uncontrolled Rectifier Operation with R and R-L Load and observe its input/output Characteristics.

7. To study Single Phase Cycloconverter output characteristics.

8. Series operation of SCR's.

9. Parallel operation of SCR's.

10. Speed Control of DC motor using SCR's.

11. Lamp-Dimmer Using Diac&TriacWith Lamp Load.

Note: At least 7 experiments should be performed from above list.

SEMESTER IV

ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS LAB

Course Code	**EE – 224(P)**		**L-0, T-0, P-2**
Name of the Course	**ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:

1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To identify the meters from the given lot.
2. To convert & calibrate a D' Arsonval type galvanometer into a voltmeter & an ammeter
3. To calibrate an energy meter with the help of a standard wattmeter & a stop watch.
4. To measure power &p.f. by 3-ammeter method
5. To measure power &p.f by 3-Voltmeter method
6. To measure power &p.f in 3-phase circuit by 2-wattmeter method.
7. To measure capacitance by De Sauty's bridge.
8. To measure inductance by Maxwell’s bridge.
9. To measure frequency by Wein's bridge,
10. To measure the power with the help of C.T & P.T.
11. To measure magnitude & phase angle of a voltage by rectangular type potentiometer.
12. To measure magnitude & phase angle of a voltage by polar type potentiometer.
13. To measure low resistance by Kelvin's double bridge.
14. To measure high resistance by loss of charge method.

Note: At least 7 experiments should be performed from above list.

SEMESTER-V
Open Elective
ENERGY ASSESSMENT AND AUDITING

Course Code	**EE – 300 (a)**	L-3, T-0, P-0	
Name of the Course	**ENERGY ASSESSMENT AND AUDITING**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

ENERGY MANAGEMENT PRINCIPLES: Systems of Energy flow, principles of Energy flow and Energy conservation, Energy and money, Energy and growth, flow of energy in ecological system, Energy efficiency and demand side management (DSM), Economic evaluation.

SECTION – B

ENERGY AUDIT: Concepts and benefits of Energy Audit, Types of Energy Audits, National Energy Plan and its impact on energy conservation, Energy accounting and analysis, Energy audits of building systems, electrical systems, maintenance and energy audits.

SECTION – C

MEASURING INSTRUMENTS: Temperature measuring instruments, combustion system measuring instruments ,measurement of heating, ventilation and air conditioning system performance.

SECTION – D

ENERGY CONSERVATION IN INDIAN SCENARIO: Energy demand and consumption in Indian industries, potential for energy efficiency in Indian industry, government's role in energy conservation and energy efficiency, Energy conservation techniques – conservation in energy intensive industries, economic evaluation of conservation techniques.

BOOKS

1. Handbook of Energy Audits by Albert Thuman – Fairman Press Inc.
2. Energy basis for man and nature by Howard T.Odum & Elisbeth.C.Odum.

SEMESTER-V

Open Elective
TOTAL QUALITY MANAGEMENT - ME-300(b)

Course Code	**ME – 300(b)**	L-3, T-0, P-0	
Name of the Course	**TOTAL QUALITY MANAGEMENT**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

Quality Control and Improvement Tools: Check Sheet, Histogram, Pareto Chart, Cause and Effect diagram, Scatter diagram, Control chart, Graph, Affinity diagram, Tree diagram, Matrix diagram, Process decision program chart, Arrow diagram, Acceptance Sampling, Process capability studies, Zero defect program (POKA-YOKE).

SECTION B

TQM PRINCIPLES: Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

SECTION C

TQM TOOLS & TECHNIQUES: The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA– Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

SECTION D

Quality Management System & Quality Audit: Quality Systems, Quality management principles, ISO-9000:2000, ISO 9001 : 2000, ISO 14000, Future of quality system audit, Audit objectives, types of quality audit, Quality Auditor, Audit performance. Case studies of TQM implementation in manufacturing and service sectors including IT.

TEXT BOOKS:

1. Dale H. Besterfiled, et at., "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint.
2. Ross, J.E.: Total Quality Management, Vanity Books International.

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", South-Western (Thomson Learning).
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India)Pvt. Ltd.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd.
5. Goetsch, D.L. & Davis,S. : Introduction to Total Quality, Prentice Hall.
6. Juran, J.M. & Gryna, F.M. : Quality Planning and Analysis, Tata McGraw Hill Publishing Co. Ltd., New Delhi
7. Charantimath, P.M. : Total Quality Management, Pearson Education.

SEMESTER-V
Open Elective
OPTIMIZATION METHODS FOR ENGINEERING SYSTEMS

Course Code	**HU-300(c)**	L-3, T-0, P-0	
Name of the Course	**OPTIMIZATION METHODS FOR ENGINEERING SYSTEMS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

Introduction: Engineering Application; Statement of the Optimal Problem; Classification; Optimization Techniques;

Classical Method: Single Variable Optimization; Multivariable Optimization Without any Constraints with Equality and Inequality Constraints.

SECTION B

One-Dimensional Minimization Method: Unimodal Function; Elimination Method – Dichotomous Search, Fibonocci and Golden Method; Interpolation Method – Quadratic and Cubic Interpolation Method.

Unconstrained Minimization Method: Univariate, Conjugate Directions, Gradient And Variable Metric Method.

SECTION C

Constrained Minimization Method: Characteristics of a constrained problem; Direct Method of feasible directions; Indirect Method of interior and exterior penalty functions.

Geometric Programming: Formulation and Solutions of Unconstrained and Constrained geometric programming problem.

SECTION D

Dynamic Programming: Concept of Sub-optimization and the principal of optimality: Calculus, Tabular and Computational Method in Dynamic Programming: An Introduction to Continuous Dynamic Programming.

Integer Programming: Gomory's Cutting Plane Method for Integer Linear Programming; Formulation & Solution of Integer Polynomial and Non- Linear problems.

TEXT BOOKS:

1. Optimization (Theory & Application)- S.S. Rao, Wiley Eastern Ltd, New Delhi.
2. Optimization Concepts and Applications in Engineering – Ashok D.Belegundu and Tirupathi R Chandrupatla – Pearson Education 1999, First India Reprint 2002.

REFERENCE BOOKS:

1. Optimization: Theory and Practice, C.S.G. Beveridge and R.S. Schechter, McGraw Hill, New York.
2. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall of India Pvt. Ltd. 2006.
3. Rao, Singaresu, S., "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2000.
4. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990.
5. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

SEMESTER-V
Open Elective
REMOTE SENSING AND GIS- CE-300(d)

Course Code	**CE-300(d)**	L-3, T-0, P-0	
Name of the Course	**REMOTE SENSING AND GIS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL: Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

PLATFORMS AND SENSORS: Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors.

SECTION B

IMAGE INTERPRETATION AND ANALYSIS: Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image Classification – Supervised and unsupervised.

SECTION C

GEOGRAPHIC INFORMATION SYSTEM: Introduction – Maps – Definitions – Map Projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

SECTION D

DATA ENTRY, STORAGE AND ANALYSIS: Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data Analysis – Modeling in GIS Highway alignment studies – Land Information System.

TEXT BOOKS:

1. Lillesand, T.M., Kiefer, R.W. and J.W. Chipman. (2004). Remote Sensing and Image Interpretation. V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi.
2. Anji Reddy, M. (2001). Textbook of Remote Sensing and Geographical Information System. Second edn. BS Publications, Hyderabad.

REFERENCE BOOKS:

1. Lo. C.P. and A.K.W. Yeung (2002). Concepts and Techniques of Geographic Information Systems. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Peter A. Burrough, Rachael A. McDonnell (2000), Principles of GIS. Oxford University Press.
3. Ian Heywood (2000), An Introduction to GIS, Pearson Education Asia.

SEMESTER-V
Open Elective
OPERATING SYSTEMS- CS-311

Course Code	**CS-311**	**L - 3, T- 1, P – 0**		
Name of Course	**Operating Systems**			
Lectures to be delivered	52 (1 Hr Each) (L=39, T=13 for each semester)			
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**	
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.				**MM: 50.**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

SECTION A

Introduction to System Software: Overview of all system software's: Compiler, Assembler, Linker, Loader, Operating system, I/O manager

Fundamentals of Operating System: OS services and Components, Multitasking, Multiprogramming, Multiprocessing, Time Sharing, Buffering, Spooling, Distributed OS

SECTION B

Process and Thread Management: Concept of process and threads, Process states, Process management, Context switching, Interaction between processes and OS Multithreading
Example OS : Linux

Concurrency Control: Concurrency and Race Conditions, Mutual exclusion requirements, Software and hardware solutions, Semaphores, Monitors, Classical IPC problems and solutions, Deadlock, Characterization, Detection, Recovery, Avoidance and Prevention

SECTION C

Memory Management: Memory partitioning, Swapping, Paging, Segmentation, Virtual, memory, Overlays, Demand paging, Performance of Demand paging, Virtual memory concepts, Page replacement algorithms, Allocation algorithms, Example OS : Linux

I/O Systems: Secondary-Storage Structure, Disk structure, Disk scheduling, Disk management, Swap-space management, Disk reliability, Stable storage implementation, Introduction to clock, Clock hardware, Clock software

SECTION D

File systems: File concept, File support, Access methods, Allocation methods, Directory Systems, File protection, Free space management, Example OS : Linux
Protection & Security: Protection, Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights, Security, The security problem, Authentication, One-Time passwords, Threats, Example OS: Linux **Case Study:** Android OS

TEXT BOOKS:

1. Operating System Concepts by Silberschatz and Galvin, Wiley.
2. Operating Systems Achyut S. Godbole Tata McGraw Hill.
3. Operating system By Doeppnar, Wiley India .

REFERENCE BOOKS:

1. Operating Systems – Internals and Design Principles, by William Stallings, Prentice Hall.
2. Modern Operating Systems by Andrew S Tanenbaum, Prentice Hall India.
3. Operating Systems by Gary Nutt, Nabendu Chaki, Sarmishtha Neogy, Pearson
4. Operating Systems Design & Implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson
5. Operating Systems D. M. Dhardhere Tata McGraw Hill

SEMESTER-V
ELECTRICAL MACHINE-II

Course Code	**EE-311**	**L-3, T-1, P-0**	
Name of the Course	**ELECTRICAL MACHINE-II**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time= 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

THREE PHASE INDUCTION MOTORS: Introduction: construction, comparison of cage & wound rotors, production of rotating field, operating principle, speed & slip, rotor frequency, rotor current, relationship between rotor copper loss and rotor input, torque production, equivalent circuit, power flow diagram, testing , starting of induction motor, different types of starters.

SECTION – B

THREE PHASE INDUCTION MOTORS: Determination of efficiency, no load and blocked rotor test, construction of circle diagram, high torque cage motors. Comparison between single cage and double cage motors, cogging and crawling, speed control of induction motors.

SINGLE PHASE MOTORS: Introduction, production of rotating fields, principle, double revolving field theory, rotor slip, equivalent circuit, starting methods, types of single-phase induction motors, characteristics and applications of single-phase motors.

SPECIALIZED MACHINES: ac servo motors, switched reluctance motors, permanent magnet motors, stepper& Brushless motors

SECTION – C

SYNCHRONOUS GENERATOR: Introduction, construction of 3-phase synchronous machines, speed and frequency, Excitation system, advantages of rotating field alternators, emf equation, armature winding, coil span factor, distribution factor, actual voltage generated, armature leakage reactance, armature reaction, synchronous impedance, equivalent circuit & Phasor diagram, voltage regulation, measurement of synchronous impedance., two reaction theory, salient pole synchronous machine- two reaction model, torque angle characteristic of salient pole synchronous machine, maximum reactive power for a synchronous generator, determination of Xd and Xq, parallel operation of alternators, synchronizing power and synchronizing torque coefficient, transient conditions of alternators, constant flux linkage theorem with proof, symmetrical short circuit transients , cooling of synchronous generators.

SECTION – D

SYNCHRONOUS MOTORS: Introduction, principle of operation, construction, main features, equivalent circuit and phasor diagram of a cylindrical rotor and salient pole synchronous motor, different torques in synchronous motor, power flow equation for a synchronous motor, effect of varying field currents, effect of load changes, synchronous motor V curves and inverted V curves, starting of synchronous motors, hunting, comparison between 3-phase synchronous and induction motors, synchronous condenser, applications of synchronous motors.

TEXT BOOKS

1. Electrical Machines, Ashfaq Hussain, Dhanpat Rai, Delhi.
2. Electrical Machinery, P. S.Bhimbra, Khanna Publishers Delhi

REFERENCE BOOKS

1. Electric Machinery, Fitzgerald & Kingsley, MGH.
2. Theory of alternating current machinery, A.S. Langsdorf, TMH.
3. Electric Machines: I.J. Nagrath and D.P. Kothari, TMH, New Delhi.

SEMESTER V
TRANSDUCERS AND SIGNAL CONDITIONING

Course Code	**EE-312**	**L-3, T-1, P-0**	
Name of the Course	**TRANSDUCERS AND SIGNAL CONDITIONING**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time= 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on Sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

TRANSDUCERS: Definition of a transducer, basic requirements of a transducer, Basic principles of resistive transducers, Inductive transducers, capacitive transducers, Thermoelectric transducers Electrical
Transducers and their classification, Transducers for measuring displacement, strain, vibration, Force, torque, pressure, flow, temperature (including Strain Gauge and L.V.D.T.)

SIGNAL CONDITIONING: Basic characteristics of instrumentation amplifier, sample and Hold circuits, Digital to Analog and Analog to Digital conversion.

SECTION-B

ANALOG INSTRUMENTS: Electronic analog instruments for measurement of direct and alternating quantities, VTVM, Electronic Voltmeter, Electronic ohmmeter, Electronic multimeter.

DIGITAL INSTRUMENTS: Comparison between Digital and Analog instruments, Digital voltmeter, Digital frequency meter, Digital display methods

SECTION-C

C.R.O: Construction and synchronization of CRO , measurement of Voltage, current, phase angle and frequency using CRO, Dual trace and Dual beam oscilloscopes. , CRT, Electrostatic deflection, CRT circuits.

SIGNAL ANALYSERS: Harmonic Distortion Analyzers, Spectrum Analyzers and their applications.

SECTION-D

RECORDERS: Magnetic Tape recorders, X-Y recorders, Strip- Chart recorder.

TELEMETRY: Principle of Telemetry, Multiplexers, Characteristics of Frequency division multiplexing, Wire Link Channels and Data Acquisition systems.

TEXT BOOKS

1. A course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney.

2. Modern Electronic Instrumentation and measuring Techniques by Albert D.Helfrick and William D. Cooper, PHI.

REFERENCE BOOKS

1. Electronic Measurements and Instrumentation by Oliver and Cage.

2. Digital Instrumentation by A.J.Bouwens, TMH, N.Delhi.

SEMESTER V
HIGH VOLTAGE TECHNIQUES AND H.V.D.C.

Course Code	**EE-313**	**L-3, T-1, P-0**	
Name of the Course	**HIGH VOLTAGE TECHNIQUES AND H.V.D.C.**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max.Time=3Hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

DISCHARGES IN GASES: General characteristics of gaseous insulation, basic processes of ionization in a gas, discharges in uniform and non-uniform fields, Paschen's law, commonly used gases for insulation and their properties.

BREAKDOWN OF SOLIDS AND LIQUIDS: Different mechanisms of breakdown of solids, Intrinsic breakdown, theories of intrinsic breakdown, different theories of breakdown in liquids, commonly used solid and liquid insulating materials and their properties.

SECTION – B

LIGHTNING PHENOMENON: Charge accumulation in clouds – formation of lightning stroke, characteristics of lightning stroke, current and voltage magnitudes, protection of transmission lines and substations against lightning, lightning arrestors, switching surges, Insulation co-ordination.

SECTION – C

IMPULSE GENERATOR: Definition of impulse wave, single stage and multistage impulse generators and equivalent circuits, determination of front and tail resistance to produce a given wave shapes.

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

SECTION – D

HVDC: Merits and demerits of HVDC transmission systems, types of HVDC systems, bipolar, monopolar, back - to - back, Normal operation of an H.V.D.C link, comparison of AC and DC transmission, application of DC transmission, HVDC system requirement, Typical layout of an HVDC substation.

TEXT BOOKS

1. High Voltage Engineering byM.S.Naidu & V.Kamaraju.
2. Power System Transients and High Voltage Principles –by B.Thapar, B.R.Gupta & L.K.Khera.

REFERENCE BOOKS

1. High Voltage Engineering – by C.L.Wadhwa.
2. A course in Electrical power by Soni, Gupta, Bhatnagar.
3. D.C.transmission by E.W.Kimbark, Wiley Publication

SEMESTER V

ELECTROMAGNETIC FIELD THEORY

Course Code	**EE-314**	**L-3, T-1, P-0**	
Name of the Course	**ELECTROMAGNETIC FIELD THEORY**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time=3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks:40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION –A

INTRODUCTION: Review of vector analysis, scalar and vector product, gradient, divergence and curl of a vector and their physical interpretation, transformation amongst rectangular, cylindrical and spherical co-ordinate system

ELECTROSTATIC FIELD: Coulomb's law, electric field intensity from point charges, Electric field due to continuous field distribution of charges, gauss's law, electric displacement and displacement density, potential functions, potential field of a charge, Laplace's and Poisson's equation, capacitance and electrostatic energy.

SECTION –B

STEADY MAGNETIC FIELDS: Faraday Induction law, Ampere's Work law in the differential vector form, Ampere's law for a current element, magnetic field due to volume distribution of current and the Dirac-delta function, Ampere's Force Law, magnetic vector potential, vector potential (Alternative derivation), equation of continuity.

SECTION-C

TIME VARYING FIELDS: Equation of continuity for time varying fields, inconsistency of Ampere's law, Maxwell's field equations and their interpretation; solution for free space conditions, electromagnetic waves in a homogeneous medium, propagation of uniform plane-wave, relation between E & H in a uniform plane-wave, wave equations for conducting medium, Maxwell's equations using phasor notation, wave propagation in a conducting medium, conductors, dielectrics, wave propagation in good conductor and good dielectric, depth of penetration, polarization: linear, circular and elliptical.

SECTION-D

REFLECTION AND REFRACTION OF EM WAVES: Reflection and refraction of plane at the surface of a perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence), Brewster's angle and total internal reflection, reflection at the surfaces of a conductive medium, surface impedance, transmission-Line analogy, pointing theorem, interpretation of E x H, power loss in a plane conductor.

TRANSMISSION LINE THEORY: Transmission line as a distributed circuit, transmission line equation, traveling & standing waves, characteristic impedance, input impedance of terminated line, reflection coefficient, VSWR, Smith's chart and its applications.

TEXT BOOKS

1. Engineering Electromagnetic: Hayt; TMH
2. Electro-magnetic Waves and Radiating System: Jordan & Balmain, PHI.

REFERENCE BOOKS

1. Electromagnetic field theory: PV Gupta.
2. Electro-Magnetics. Krauss J.DF; Mc Graw Hill.

SEMESTER V
MICROPROCESSOR THEORY & APPLICATIONS

Course Code	**EC-311**	**L-3, T-1, P-0**	
Name of the Course	**MICROPROCESSOR THEORY & APPLICATIONS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	**Max. Time= 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

Introduction: Evolution of microprocessor, General Architecture Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor IC pin outs and signals, address, data and control buses, 8085features Addressing Modes:- Direct addressing, indirect addressing, indexed, register direct, register indirect, implicit addressing mode, Timing diagrams. Typical instruction set of 8085, data manipulation, data transfer, status management instructions.

SECTION – B

Programming: Development of Assembly language program. Interrupts & data transfer: Interrupt system of 8085• Stack and subroutine Types of memory and memory interfacing Decoding techniques – absolute and partial • Mapping techniques – I / O mapped I /O and memory mapped I / O. Serial I/O lines of 8085 and the implementation asynchronous serial data communication using SOD and SID.

SECTION – C

Peripheral devices & applications of microprocessor: Description of 8251, 8255, 8253, 8257, 8259, 8279. Cycle stealing and burst mode of DMA controller. Synchronous and asynchronous data transfer using 8251

SECTION – D

8086 and 8088 Microprocessors: Architecture and organization of 8086/8088 microprocessors family, bus interface unit,8086/8088 hardware pin signals, timing diagram of 8086 family microprocessors, simplified read/ write bus cycles, 8086 minimum and maximum modes of operation, 8086/8088 memory addressing, address decoding, memory system design of 8086 family, timing considerations for memory interfacing, input/output port addressing and decoding, introduction to 8087 floating point coprocessor and its connection to host 8086. Introduction to Modern Microprocessor.

Text Books -

1. Microprocessor & Architecture, programming and application by Gaonkar.
2. Microprocessors and Digital Systems, D.V.HALL, McGraw Hill
3. Microprocessor and Microcontrollers, Senthil, Saravanam (Oxford University Press)

Reference Books:

1 An introduction to microprocessor – A.P. Mathur.
2 The 8086 Microprocessor –Kenneth J Ayala
3. Fundamentals of microprocessor & microcomputers – B.Ram

SEMESTER-V

ELECTRICAL MACHINES – II LAB

Course Code	**EE – 311(P)**		**L-0, T-0, P-3**
Name of the Course	**ELECTRICAL MACHINES – II LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks:10**	**Maximum Time:3hrs**
Continuous Assessment	**Lab work 30% Lab Record 25%, Viva 25% Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

INDUCTION MOTOR

1) Single Phase Induction Motor
No load test and Block rotor test
2) Three phase slip ring induction motor
a) No load test
b) Block rotor test
c) Load test
3) Three phase squirrel cage induction motor
a) No load test and Block rotor test
b) Load test
4) Starting of three phase induction motor.
a) Stator resistance starting
b) Reduced voltage starting
c) Autotransformer starting
d) Star delta starting
e) Rotor resistance starting
f) Direct on line (DOL) starting
5) Cascading of two induction motors
6) Speed changing by Pole changing method

SYNCHRONOUS MACHINE

1. To draw characteristics of alternator under different loading condition.
2. To find out regulation by synchronous impedance method.
3. To find out regulation by zpf method.
4. SYNCHRONISATION
a) To synchronize a three phase alternator with bus bar.
b) Parallel operation of two alternators.
5. V- CURVES OF SYNCHRONOUS MOTOR
a) To study the effect of variation of field current upon the stator current and p.f. with synchronous motor running at no load, draw the V-curves and inverted V- curves of the motor.

6. STEADY STATE REACTANCES (Xd, Xq)/SLIP TEST
a) To measure the direct axis synchronous reactance of a synchronous machine.
b) To measure quadrature axis synchronous reactance by slip test.
7. SUBTRANSIENT REACTANCES: Xd", Xq"
a) To measure the direct axis synchronous sub transient reactance of a synchronous machine.
b) To measure quadrature axis synchronous sub transient reactance of a synchronous machine.
8. NEGATIVE SEQUENCE REACTANCE: X2
a) To measure the negative sequence reactance X2 of synchronous machine.
9. ZERO SEQUENCE REACTACE: X0
a) To measure the zero sequence reactance of synchronous machine.
10 THREE PHASE CIRCUIT OSCILLOGRAPH
a) To record the oscillogram of armature current in various phases under three-phase sudden short circuit.

Note: At least 8 experiments should be performed from above list.

SEMESTER V
TRANSDUCERS AND SIGNAL CONDITIONING LAB

Course Code	**EE – 312(P)**		**L-0, T-0, P-3**
Name of the Course	**TRANSDUCERS AND SIGNAL CONDITIONING LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Viva 25%**	**Lab Record 25%,** **Attendance 20%**	**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

(1) To study LVDT and plot its response to an application.

(2) To study Strain Gauge and plot its response to an application.

(3) To plot the characteristics of a Thermistor and calibrate it for temperature measurement.

(4) To plot the characteristics of a Thermocouple and calibrate it for temperature measurement.

(5) (a) To observe waveform of a signal on CRO and measure its amplitude and frequency.
(b) To measure frequency of an unknown signal using Lissajous patterns on CRO.

(6) To study the working of a general purpose Spectrum Analyzer.

(7) To study an angular potentiometric transducer and measure its sensitivity and linearity.

(8) To study the working of a Digital Multimeter.

(9) To study the working of a Data Acquisition System.

(10) To study an Instrumentation Amplifier and plot its response to an application.

Note: At least eight experiments to be performed from above list.

MICROPROCESSOR THEORY & APPLICATIONS LAB
(EC – 311(P))

Course Code	**EC – 311(P)**	L-0, T-0, P-3	
Name of the Course	**MICROPROCESSOR THEORY & APPLICATIONS LAB**		
Lectures to be Delivered	26 hours of Lab sessions (2 hrs. per week)		
Semester End Examination	Max Marks:25	Min Pass Marks: 10	Maximum Time: 3 hrs
Continuous Assessment	Lab work 30%, Lab Record 25% Viva/ Hands on 25% Attendance 20%		Max Marks:25

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:

1. Performing a practical examination assigned by the examiner
2. Viva-voce examination

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

8085 Based

1 Addition and subtraction of two 8-bit numbers with programs based on different addressing modes of 8085A.
2 Addition and subtraction of two 16-bit numbers. (Using 2's complement method, also programs which access numbers from specified memory locations.)
3 Addition and subtraction of two 16-bit BCD numbers. (using DAA instruction.)
4 Multiplication of two 8-bit numbers using the method of successive addition and Shift & add.
5 Division of two 8-bit numbers using the method of successive subtraction and shift & subtract.
6 Block transfer and block exchange of data bytes.
7 Finding the smallest and largest element in a block of data.
8 Arranging the elements of a block of data in ascending and descending order.
9 Converting 2 digit numbers to their equivalents.
a) BCD to HEX and b) HEX to BCD
10 Generating delays of different time intervals using delay subroutines and measurement of delay period on CRO using SOD pin of 8085A.
11 Generation of Fibonacci Series.

Application Based (Max 2)

1 Program controlled data transfer using 8255 PPI.
A) To INPUT data bytes from peripheral port and to store them in memory.
B) To OUTPUT data bytes from memory to peripheral port.
2 Study of interrupts by enabling them in main line program and then executing different subroutines when TRAP, RST 7.5, RST 6.5 & RST 5.5 are activated.
3 Interfacing 7 segment LED display using 8255A – in static and dynamic mode.
4 Interfacing ADC 0808/0809.
5 Interfacing DAC 0808.
6 Interfacing stepper motor with microprocessor using 8255A – in Half and Full excitation.
7 Interfacing of 8253 / 8254.

SEMESTER VI

PRINCIPLES OF MANAGEMENT AND CRITICAL THINKING (HS-301)

Course Code	**HS-301**	**L - 3, T- 0, P - 2**	
Name of Course	**Principles of Management and Critical Thinking**		
Lectures to be delivered	**65 (L-39, P-26 for each semester)**		
Semester End Examination	**MM: 100**	**Min. Marks; 40**	**Time Allowed: 3 Hrs.**
Continue Assessment (based on sessional tests 50%) Tutorial/ Assignment: 30%, Quiz/ Seminar: 10 %, Attendance: 10 %.			**MM: 50.**

INSTRUCTIONS:

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus. Section A, B, C & D will have two questions from the respective sections of the syllabus. Each section will have a weightage of 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E.

Course Objectives:

- To understand the roles and functions of managers at various (entry, middle and the top) levels
- To explain the relationships between organizational mission, goals, and objectives
- To comprehend the significance and necessity of managing stakeholders
- To conceptualize how internal and external environment shape organizations and their responses
- To demonstrate empirical understanding of various organizational processes and behaviours and the theories associated with them
- To demonstrate critical thinking skills in identifying ethical, global, and diversity issues in planning, organizing, controlling and leading functions of management
- To understand organizational design and structural issues

Learning Outcomes: On completion of this course the students should be able to:

- Describe the functions of management.
- Outline the historical theories relating to modern management.
- Explain the role of management within a business setting.
- Describe human resource planning and staffing processes needed to achieve optimal performance
- Prepare a business forecast and budget.
- Illustrate how business ethics and social responsibility apply to organizations.
- Describe formal and informal organizational communication processes and how to influence employees

SECTION A

Historical Perspectives of Management: **(6 Hours)**

- The behavioural approach to management
- The management science approach
- The contingency approach
- The system approach

Principles of Planning **(5 Hours)**

- Defining planning, Purposes of planning,
- Advantages and potential disadvantages of planning,
- Management by objectives, Planning tools,
- Strategic planning, Forecasting and budgeting

SECTION B

The Management Task **(4 Hours)**

- The Role of management,
- Defining management,
- The management process, management functions,
- Management goal attainment,
- Management and organizational resources

Fundamentals of Organizing **(5 Hours)**

- The definition of organizing
- The organizing process
- The organizing subsystem
- Classical organizing theory

SECTION C

Leadership and Effective Communication **(3 Hours)**

- Defining leadership; leader vs. manager,
- Leadership behaviours, Transformational Leadership,
- Coaching, Entrepreneurial leadership

Controlling for Productivity (**4 Hours)**

- Defining production and productivity,
- Quality and productivity, Operations management,
- Operations control, Using control tools to control organizations

SECTION D

Managerial Ethics and Social Responsibility **(6 Hours)**

- Fundamentals of social responsibility,
- Areas of corporate social responsibility,
- Social responsiveness and decision making,
- Influencing individuals performing social responsibility activities,
- A definition of ethics, Creating an ethical workplace

Making Good Business Decision **(6 Hours)**

- Types of decisions, Elements of the decision situation,
- The decision making process, Decision making conditions,
- Decision making tools, Processes for making group decisions

TEXT BOOKS:

1. Charles W. L. Hill and Steven McShane (2006) Principles of Management. McGraw-Hill/Irwin; 1st Edition. ISBN-10: 0073530123, ISBN-13: 978-0073530123
2. Moore & Parker, Critical Thinking, 9th ed. (McGraw-Hill, 2008) ISBN-13: 9780073386676

REFERENCE BOOKS:

1. Gary Dessler (2003). Management: Principles and Practices for Tomorrow's Leaders, Prentice Hall; 3rd Edition. ISBN-10: 0131009923, ISBN-13: 978-0131009929
2. Ellen A. Benowitz (2001). Principles of Management. Cliffs Notes. ISBN-10: 076456384X, ISBN-13: 978-0764563843
3. Griffin, Ricky W., Management seventh edition, Houghton Mifflin Company
4. Fisher, Alec. The Logic of Real Arguments (Second Edition). Cambridge: Cambridge University Press, 2004.

PRACTICAL CLASS DISCUSSION TOPICS

Some Basics: Issues, Claims, Arguments- Types & Structures, Clarity- Vagueness, Ambiguity, Credibility, Rhetoric, & Fallacies, Formal Deductive Logic, Deductive Arguments: Truth-Functional Logic

(a) Symbolization; (b) Truth Tables; (c) Long Truth Table Test; (d) Short Truth Table Test;
(e) Deductions w/Inference Rules; (f) Deductions w/Equivalence Rules

Left brain /right brain exercise, Truth and Knowledge, Good and Bad Reasoning, Inductive and Deductive Reasoning, Fallacious Reasoning, Psychological Impediments to Cogent Reasoning Truth, Belief, and the Leader/Follower Relationship.

SEMESTER VI

SWITCHGEAR AND PROTECTION

Course Code	**EE – 321**	**L-3, T-1, P-0**	
Name of the Course	**SWITCHGEAR AND PROTECTION**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on Sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

RELAYS: Operating Principles, constructional features and characteristics of relays. Relay Classification, principal types of electromagnetic relays, theory of Induction relays, relay design, General equation for electromagnetic relays, over current relays, Instantaneous over current relay, Directional relays, Distance relays, Differential relays.

SECTION – B

FEEDER PROTECTION: Over current protection, Distance protection, Pilot protection.

APPARATUS PROTECTION: Types of faults on transformers, Transformer protection, Types of faults on stator and rotor, generator protection, Motor protection. Bus bar protection, C.T.s, P.T.s and their application in protective schemes.

SECTION – C

STATIC RELAYS: Basic concepts, logic circuits, smoothing circuit, voltage regulators, square-wave generator, time delay circuits, level detectors, Input Output devices and circuits, Phase and amplitude comparator, general equation of comparators, general organization of static relays.

PROTECTION AGAINST OVER VOLTAGES: Ground wire, shielding angle, rod gap, horn gap, impulse gap, valve type and non linear arrestors, surge absorbers.

SECTION – D

THEORY OF CIRCUIT INTERRUPTION: Physics of arc interruption, maintenance of arc, arc interruption theories.

THEORY OF CIRCUIT BREAKERS: Circuit breaker rating, Restriking voltage, current chopping, interruption of capacitive current Air break circuit breaker, oil circuit breaker, Air blasts circuit breaker, Vacuum circuit breaker, SF6 circuit breaker, Testing and maintenance of circuit breakers.

TEXT BOOKS

1. A course in Electrical Power by Soni, Gupta, Bhatnagar.
2. Power System Protection and Switchgear by B.Ravinder Nath & M.Chander, Wiley Eastern.

REFERENCE BOOKS

1. Switchgear and Protection by Sunil S.Rao.
2. Art and Science of Protective relaying by C.R.Mason, John Wiley.
3. Electrical Power Systems by C.L.Wadhwa.

SEMESTER VI

CONTROL ENGINEERING - I

Course Code EE –322 **(L-3, T-1, P-0)**

Course Code	**EE – 322**	L-3, T-1, P-0	
Name of the Course	**CONTROL ENGINEERING - I**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on Sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

INTRODUCTION: Basic concept of automatic control, servo mechanism, regulating systems, open loop and closed loop control systems, feedback, effects of feedback, linear and non-linear control systems, Block diagrams, examples of various control systems.

MODELLING: Formulation of differential equations of linear electrical, mechanical, translational, rotational and thermal systems, electrical and mechanical analogies, use of Laplace transform and transfer function, concept of state variable modelling, block diagram algebra, signal flow graphs, characteristic equation.

SECTION – B

TIME DOMAIN ANALYSIS: Standard test signals, transient response of the first order, second order systems, time domain specifications, dominant closed loop poles of higher order systems, steady state error and error coefficients.

STABILITY: Concept of absolute and relative stability, pole - zero location, Routh – Hurwitz criterion.

SECTION – C

FREQUENCY DOMAIN ANALYSIS: Closed loop frequency response, correlation between time and frequency response, Bode diagram, polar plots, log magnitude vs. phase plot.

STABILITY IN FREQUENCY RESPONSE: Nyquist stability criterion, stability analysis, relative stability.

SECTION – D

COMPENSATION DESIGN: Necessity of compensation, compensating network, phase margin, gain margin, lag and lead compensation.

CONTROL SYSTEM COMPONENTS: Error detectors – potentiometers and synchronous, stepper motor, servo motor, ac and dc tacho generators.

TEXT BOOKS

1. Control System Engineering by I.J.Nagrath & M.Gopal.
2. Modern Control Engineering by K.Ogata (PHI)

REFERENCE BOOKS

1. Modern Control System by Dorf and Bishop Pub Perarson Education
2. Automatic Control System by B.C.Kuo (PHI)
3. Control System Components by J.F.Gibsen (MGH)

SEMESTER VI

ELECTRICAL POWER GENERATION

Course Code	**EE – 323**	L-3, T-1, P-0	
Name of the Course	**ELECTRICAL POWER GENERATION**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

LOAD CURVES: Energy requirements, connected load, maximum demand, demand factor, diversity factor, types of load, variation in demand, Chronological load curve, load duration curve, Energy load curve, Mass curve, load factor, Capacity factor, utilization factor.

SECTION-B

CONVENTIONAL METHODS OF GENERATION:

Hydro Stations- location, layout, types and selection of prime mover, calculation of energy generated.

Thermal stations- Location, layout, calculations of energy generated.

Nuclear stations-Principle of nuclear generation, location, layout and calculation of energy generated.

SECTION-C

Non Conventional Power Generation: Geothermal power plants, Electricity from biomass, Direct energy conversion systems, Thermo-Electric conversion system, Fuel Cells, Magneto Hydro Dynamic system.

SECTION-D

Integrated Operation of Power Plants: Integrated operation of different power plants, base load and peak load power plants, plant capacity factor, sequence of adding units, load dispatching.

TEXT BOOKS

1. A Course in Electrical power by Soni, Gupta, Bhatnagar.
2. Elements of Electrical Power Station Design by M.V.Deshpande.

REFERENCE BOOKS

1. Power station Engineering and Economics by Strotzky and Uopat.

SEMESTER VI

ELECTRICAL DRIVES & FACTS

Course Code	**EE – 324**	L-3, T-1, P-0	
Name of the Course	**ELECTRICAL DRIVES & FACTS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

Introduction to an Electric Drive System: Dynamic equations of an electric drive, torque equations, multi-quadrant operation, type of loads, energy loss during transients and load equalization.

SECTION-B

Control of Electric Drives: Speed control, closed loop position and speed control. Selection of motor rating thermal model of motor, classes of duty and determination of motor rating for different classes duty.

DC Motor Drives: Starting, braking, transient analysis, speed control, controlled rectifier converters for DC drives and chopper fed DC drives. Induction motor drive – starting, braking, transient analysis, speed control

SECTION-C

Induction Motor Drives: Starting, braking, transient analysis, speed control, ac controller fed induction motor, voltage source inverter, current source inverter and cylco-converter fed induction motor drive.
Special Purpose Drives: Brushless DC, stepper and reluctance motor.

SECTION-D

Introduction to FACT controllers
Principle and operation of thyristor controlled Dynamic brake and VAR compensators**.**

TEXT BOOKS:

1. Electrical Drives- G.K. Dubey, Narosa Publishing House.

SEMESTER VI

MICROCONTROLLERS & EMBEDDED SYSTEMS

Course Code	**EC – 321**	L-3, T-1, P-0	
Name of the Course	**MICROCONTROLLERS & EMBEDDED SYSTEMS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

Comparison of microprocessor and microcontroller. Architecture and pin functions of 8051 chip controller. CPU timing and machine cycles. Internal memory organization. Program counter and stack. Input/output prots. Counters and timers. Serial data input and output interrupts. Power saving modes.Hours

SECTION – B

Programming with 8051: Instruction set, addressing modes. Immediate, registers, direct and indirect data movement and exchange instructions. Push and pop op-codes. Arithmetic and logic instructions, bit level operations, jump and call instructions, input/output port programming, programming timers, asynchronous serial data communications and hardware interrupt service routines interfacing of LCD display hex keyboard ADC0808. DAC0808 and stepper motor with 8051.

SECTION – C

Comparative study of salient features of 8051 and its derivatives like 89C51,89C52, 89C2051 and 89C2052. Current processor and controller survey. (cost, availability, popularity)

32-bit RISC Based ARM Architecture: Important features, Instruction set, Programming Examples, Core based Embedded Systems, Soft and Hard Cores, Xilinx FPGA architectures, 8-bit Picoblaze Microcontroller Core, 32-bit Microblaze Soft Core, Power PC

SECTION – D

Introduction to Embedded systems: Embedded system examples, Parts of Embedded System-Processor, Power supply, clock, memory interface, interrupt, I/O ports, Buffers, Programmable Devices, ASIC,etc. interfacing with memory and I/O devices. Memory Technologies – EPROM, Flash, OTP, SRAM,DRAM, SDRAM etc

Embedded System Design: Embedded System product Development Life cycle (EDLC), Hardware development cycles- Specifications, Component selection, Schematic Design, PCB layout, fabrication and assembly. Product enclosure Design and Development.

TEXT BOOKS

1. Mazidi & Mazidi, The 8051 microcontroller & embedded system, using assembly and C, 2nd edi, pearson edu.
2. Mckenzie, Scott, The 8051 Microcontroller, PHIs, (1995) 5th ed.

REFERENCE BOOKS

1. Simon, David E., An Embedded System Primer, Pearson Education, (2005) 4th ed.
2. The Art of Programming Embedded Systems, Jack G. Ganssle, Academic press. Intelligent Embedded Systems, Louis L. Odette, Addison-Wesley, 1991
3. The 8051 Micro controller Architecture, programming &Applications : Kenneth J. Ayala.

SEMESTER VI

SWITCHGEAR AND PROTECTION LAB

Course Code EE–321(P) **(L-0, T-0, P-2)**

Course Code	**EE – 321(P)**		**L-0, T-0, P-2**
Name of the Course	**SWITCHGEAR AND PROTECTION LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To plot time current characteristics of Electromagnetic type over-current relay.
2. To plot time-current characteristics of an IDMT relay.
3. Performance and study of Merz-Price protection.
4. Study of the performance and operation of a three phase over-current and earth fault static relay.
5. To study and plot the characteristics of impedance relay.
6. To study directional over current relay.
7. To study transformer differential protection.
8. To study the magnetization characteristics of C.T.
9. To study the problem associated with C.T. magnetization.
10. Visit to substation and prepare layout of various equipments in the substation.

Note: At least eight experiments to be done from above list.

SEMESTER VI
CONTROL ENGINEERING – I LAB

Course Code	**EE – 322(P)**		**L-0, T-0, P-2**
Name of the Course	**CONTROL ENGINEERING – I LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To Study the step response of a second order system for different damping factors.
2. To plot the speed torque characteristics of a 2 phase AC servomotor.
3. To plot the torque speed characteristics of a DC servomotor.
4. To study the closed loop control of a three phase AC motor.
5. To study the performance characteristics of a D.C. motor angular position control system.
6. To study the magnetic amplifier.
7. To Study the synchro transmitter rotor position versus stator voltages for three phase.
8. To Study the microcontroller based stepper motor controller circuit.
9. To Study various lag-lead compensation networks.

Note: At least eight experiments to be performed from above list.

SEMESTER VI
MICROCONTROLLERS & EMBEDDED SYSTEMS LAB

Course Code	**EC – 321(P)**		**L-0, T-0, P-2**
Name of the Course	**MICROCONTROLLERS & EMBEDDED SYSTEMS LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

8051 experiments (Min 3)
1.Arithmetic operations
2.Packing and unpacking
3.Ascending and descending
4.8051 timer based experiment
5.Transmission of character using RS 232 to PC(preferably on bread board)
6.16 * 2 LCD and Hex keyboard interface (preferably on bread board)
7.ADC or DA C interface (any application) (preferably on bread board)

Using ARM Processor.
Experiments are to be performed on Proteus VSM Platform (any 4)
To design and test circuits on
1.LED blinking,
2.7segments display,
3.16x2 multiple character LCD,
4.Run stepper motor/ DC motor,
5.Implement square wave,
6.Temperature display using
7.Demonstration of traffic lights,
8.Speed control of motor,
Using ARM Processor.

PIC 18
Experiments are to be performed on Proteus VSM Platform (any 4)
To design and test circuits
1. Addition, subtraction
2. BCD Adder
3. Multiplication Division
4. 4 bit LCD driver
5. Working of ADC / DAC
6. Demonstration of Traffic light
7. Implement door bell
8. Data Logger
9. Working of calculator

SEMESTER – VII
ELECTIVE – I (DEPTT.)

DIGITAL CONTROL SYSTEM

Course Code: EEE – 411(a) **(L-3, T-1, P-0)**

Course Code	**EEE – 411(a)**	L-3, T-1, P-0	
Name of the Course	**DIGITAL CONTROL SYSTEM**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section A:

Discrete Time Signals and Systems:
Introduction, Sampled Data Control Systems, sampling and data reconstruction.

Transform Analysis of Discrete Systems:
Introduction, Linear Difference equations, The Pulse Transfer Function and pulse response, Z-transform, equivalence of Z-domain to S-domain, stability analysis.

Section B:

Design of Digital Controlers:
Introduction, Design of a positional servo mechanism, Digital PID controller, multivariable controllers.

Section C:

State Space Models of Discrete Time Systems:
Introduction, Discrete-time state equation and solution, Design examples, concept of controllability and observability, Liapunov stability analysis.

Section D:

State Estimation and Filtering:
Introduction, necessity of estimation, Principles of least squares, Recursive Least Squares algorithm, Kalman Filtering, Parameter estimation.

TEXT BOOKS:

1. Gopal M, "Digital Control Engineering", WE Ltd. New Delhi – (1993)
2. Katsuhiko Ogata, "Discrete-Time Contrl Systems", PHI New Delhi

REFERENCE BOOKS:

1. Kuo B C, "Analysis & synthesis of SD-control system", Prentice Hall, N.J. (1963)
2. Jury E I, "Theory and application of Z-transform methods" John Wiley – (1964)
3. Medich K, "State Estimation", McGraw Hill International, 1963
4. Lindorff D P, "Theory of Sampled Data control Systems", John Wiley, 1966

References:

1. NPTEL lectures

SEMESTER – VII

ELECTIVE – I (DEPTT.)

POWER PLANT ENGINEERING

Course Code	**EEE – 411(b)/EE – 411(b)**	L-3, T-1, P-0	
Name of the Course	**POWER PLANT ENGINEERING**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Hydro-Electric power plants: Introduction, Hydrology, Stream flow, Hydrographs, Flow duration curves, Mass curve, Types of dams, arrangement and location of hydro-electric station, types of hydroelectric plants and their fields of use, principle of working of a hydroelectric plant. Types of turbines and their Characteristics. Draft tubes, Turbine setting, penstock dimensions.

Section-B

Steam Power plant: Introduction, Merits and demerits, site selection, working and its layout, steam turbines, fuel handling, fuel combustion and equipments, ash handling, dust collection, steam power plant controls, auxiliaries, turbo-alternators

Section-C

Nuclear Power plant: Introduction, Merits and demerits, site selection, working and its layout, nuclear reaction, nuclear fission process, nuclear chain reaction, nuclear reactor and their functions, reactor control, classification of nuclear reactors, pollution and its control from nuclear power plants.

Section-D

Brief review of Diesel and Gas turbine power plants

Control of Power plants: Instrumentation scheme for monitoring and control of various parameters of power plants through control panels. Instrumentation scheme for operation and maintenance of generating units. Automatic load dispatch using computers. Computer based data acquisition system for power plant operations, maintenance and protection. Instrumentation schemes used for HVDC & EHVAC transmission systems.

TEXT BOOKS:

1. A Course in Power Plant Engineering by Arora and Domkundwar – Publisher Dhanpat Rai & Co

SEMESTER VII
ELECTIVE – I (DEPTT.)
INDUSTRIAL CONTROL

Course Code	**EEE – 411(c)**	L-3, T-1, P-0	
Name of the Course	**INDUSTRIAL CONTROL**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Introduction to industrial automation and control, Architecture of industrial automation system, introduction to sensors and measurement system. Measurement of Temperature – Gas Pressure Thermometer, Thermocouples, using thermocouple tables; Pressure – Piezo element, Vacuum measurement – Pirani Gauge, Ionization Gauge,pressure transducer specifications; Displacement – Shaft encoders, LVDT, Proximity detectors; Flow – Differential Pressure flow meter, turbine flow meter, electromagnetic flow meter, ultrasonic flow meter; Level – ultrasonic method, Humidity and pH.

Section-B

Signal conditioning and processing, Estimation of error and calibration, Introduction to process control, PID control, Controller tuning, Implementation of PID controllers, Special Control Structures: - Feed-forward and ratio control, predictive control, control of systems with inverse response, Cascade control, Overriding Control, Selective Control, Split range control

Section-C

Introduction to sequence control, PLC (Programmable Logic controllers) and Relay Ladder Logic (RLL), Scan Cycle, RLL syntax, Structured design approach, Advanced RLL programming, Hardware for sequence control, Introduction to CNC machine.

Section-D

Actuators: Flow control Valves; Hydraulic actuator system – Principal, components, Pumps and motors, Proportional and servo valves; Pneumatic Control Systems : System Components, Controllers and Integrated Control Systems; Electric Drives – Introduction, Energy saving and adjustable speed. Synchronous motor drives – adjustable speed and servo drives. The Field Bus – Networking of sensors, Actuators and Controllers, The Field bus Communication Protocol.

TEXT BOOKS:

1. Industrial Control Handbook by E A Parr 3rd Edition, Publisher Industrial Press
2. Process Control: Instrument Engineers handbook by B. Liptak
3. Chemical Process Control by G. Stephanopoulos , PHI, New Delhi

REFERENCE BOOKS

4. Process Control: Modeling, Design, and Simulation by B. Wayne Bequette Prentice Hall
5. Process Control by K. Krishnaswamy, New Age Publications
6. Modern Control Engineering by K. Ogata, PHI New Delhi
7. NPTEL Lecture notes.

SEMESTER – VII
ELECTRICAL MACHINE DESIGN

Course Code	**EE – 412**	L-3, T-1, P-0	
Name of the Course	**ELECTRICAL MACHINE DESIGN**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

GENERAL: Review of materials used in Electrical Machines – their characteristics and limitations, classification of insulating materials based on temperature rise, BIS specifications for conductors, transformers, transformer oil and induction motors, Standard specifications for rotating electrical machinery as per IEC publications

TEMPERATURE RISE CALCULATIONS: Losses in electric machines, classification of losses, temperature rise calculation, steady state temperature rise, heating and cooling curves, ratings of machines

VENTILATION: Methods of cooling transformers, design of tank, types of ventilation, methods of Cooling 3 phase induction motor, cooling circuits and types of enclosures, cooling of totally enclosed machines, Hydrogen cooling direct water cooling, Quantity of cooling medium – Air, Hydrogen, water and oil

SECTION – B

MAGNETIC CIRCUITS: Magnetic circuits of transformers and three phase induction motors, magnetic loading of transformers and induction motors, Specific slot permeance and slot leakage reactance of a 3-phase induction motor, Leakage reactance's of cylindrical coils of equal length and sandwich coils of equal width in a transformer.

ELECTRIC CIRCUITS: Types of low voltage and high voltage windings in transformers, bracings, Characteristics of a.c .armature windings, types of windings used for induction motors, winding factors.

SECTION – C

TRANSFORMERS: Design of single - phase and three - phase core type power and distribution transformers, single phase shell type transformers, magnetic and electric circuit, leakage reactance, regulation, efficiency, no load current, cooling system, overall dimensions and weight, computer aided design of transformers.

SECTION – D

INDUCTION MOTORS: Design of squirrel cage and wound rotor type three phase induction motors, stator and its windings, slot and its insulation, squirrel cage and slip ring rotors, no load current, short circuit current, efficiency, stator temperature rise, weight, computer aided design of induction motors.

TEXT BOOKS:

1. A Course in Electrical Machine Design by A.K. Sawhney.
2. Design Manual by Say and Smith.

REFERENCE BOOKS

1. Electrical Machine Design by L.K. Khera.
2. Alternating Current Machines by M.G.Say.
3. Advanced Electrical Machines and Power by B.G.Brosen and J.T.Hayden report, SWOT analysis

SEMESTER-VII
BIOMEDICAL ENGINEERING

Course Code: EE –413 **(L-3, T-1, P-0)**

Course Code	**EE – 413**	L-3, T-1, P-0	
Name of the Course	**ELECTRICAL MACHINE DESIGN**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

FUNDAMENTALS OF MEDICAL INSTRUMENTATION: Anatomy and physiology, physiological systems of the body, sources of biomedical signals, basic medical instrumentation system, performance requirements of medical instrumentation systems, General constraints in design of medical instrumentation systems, regulation of medical devices.

BIOELECTRIC SIGNALS AND ELECTRODES: Origin of bioelectric signals, recording electrodes, Silver Silver chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes for EMG, Electrical Conductivity of electrode jellies and creams, Microelectrodes.

SECTION-B

PHYSIOLOGICAL TRANSDUCERS: Introduction, classification of transducers, performance characteristics of transducers, Displacement, position and motion transducers, Pressure transducers, Transducers for body temperature measurement, Photoelectric transducers, optical fiber sensors, Biosensors, Smart sensors.

RECORDING SYSTEMS: Basic recording systems, General considerations for signal conditioners, pre ampliers, sources of noise in low level measurements, Biomedical signal analysis techniques, main amplifier and driver stage, Writing systems, Direct writing recorders, inkjet recorder, potentiometer recorders, Digital recorders, Instrumentation tape recorders.

SECTION-C

BIOMEDICAL RECORDERS: Electrocardiograph, Vector cardiograph(VCG), honocardiograph (PCG),Electro encephalograph (EEG), Electromyograph (EMG), other biomedical recorders, Biofeedback instrumentation.

X-RAY COMPUTED TOMOGRAPHY: Computed Tomography, system components, Gantry geometry, patient dose in CT scanners.

SECTION-D

Basis of Diagnostic Radiology, Nature of X-rays, production of X-rays, X-ray machine, visualization of X-rays, Dental X-ray machines, portable and mobile X-ray units, physical parameters for X-ray detectors, Digital radiography.

TEXT BOOK

1. Handbook of Biomedical Instrumentation - By R.S.Khandpur (TMH)
2. Principles of Applied Bio-medical Instrumentation by L.A. Geddes & L.E.Baker (Wiley Inter Science Publication)

SEMESTER – VII
POWER SYSTEM OPERATION AND CONTROL

Course Code	**EE – 414**	L-3, T-1, P-0	
Name of the Course	**POWER SYSTEM OPERATION AND CONTROL**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

CHARACTERISTICS OF POWER GENERATION UNITS: Characteristics of steam units, Characteristics of hydro-units, Input Output and incremental fuel cost characteristics.

UNIT COMMITMENT: Constraints in unit commitment, solution of the unit commitment Problem by Priority list method and Forward Dynamic Programming Approach.

SECTION – B

ECONOMIC DISPATCH OF THERMAL UNITS: Economic dispatch problem, thermal System dispatching with network losses considered, Base point and participation factors, Line Loss formula (derivation not included), Solution of co-ordination equations by iteration method And Newton – Raphson method.

SECTION – C

HYDRO-THERMAL CO-ORDINATION: Short term hydro – thermal scheduling problem, Solution of co-ordination equations by iteration method, Dynamic programming, dynamic Programming application to hydro-thermal problem.

SECTION – D

POWER SYSTEM CONTROLS: Generator voltage control, Turbine governor control, and load Frequency control, co-ordination of economic dispatching with load frequency control.

TEXT BOOKS

1. Power generation operation and control by A.J.Wood and B.F.Wollenberg, John Wiley & Sons.
2. Power System Engineering by Nagrath & Kothari, TMH.
3. Power System Analysis and Design by B.R.Gupta,

SEMESTER VII
COMMUNICATION ENGINEERING

Course Code	**EE – 415**	L-3, T-1, P-0	
Name of the Course	**COMMUNICATION ENGINEERING**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION –A

FREQUENCY BANDS AND SIGNALS: Various frequency bands used for communication and their special features, Need for wireless communication, Types of communication based on modulation systems, types of various signals.

MODULATION TECHNIQUES: Introduction to AM, FM, PM, PCM, PPM, DSBSC, Frequency spectrum of AM Waves, Representations of AM, need and descriptions of SSB, suppression of carrier, suppression of unwanted side bands, vestigial side band system. Mathematical representation of FM, Frequency spectrum of the FM waves, Phase modulation, comparison between analog and digital modulation, wide band and narrow band FM. Sampling theorem, frequency division multiplexing and time division multiplexing.

SECTION-B

AM TRANSMITTERS AND RECEIVERS: AM TRANSMITTERS: generation of AM, Low Level and High-level modulation, Comparison of levels, AM transmitter block diagram, collector class C modulator, and Base modulator, DSB S/C Modulator.

AM RECEVIER: Tuned radio frequency (TRF) receiver, Super heterodyne receiver, RF section and characteristics, mixers, frequency changing and tracking, IF rejection and IF amplifiers, detection and automatic gain control (AGC), AM receiver characteristics.

SECTION - C

FM TRANSMITTERS AND RECEIVERS: FM TRANSMITTERS: Basic requirements and generation of FM, FM Modulation methods: Direct methods, varacter diode methods, FET reactance modulator, Transistor reactance modulation, Pre-emphasis, direct FM modulator, AFM in reactance modulation, RC Phase Shift modulation, Armstrong FM systems.

FM RECEIVERS: Limiters, single and double tuned demodulator, balanced slope detector, foster seely of phase discriminator, de- emphasis, ratio detector, block of FM receiver, RF amplifiers, FM receiver characteristics.

SECTION-D

Broad overview of PCM, DM, and ADM. Review of sampling, flat top sampling, quantization, Analog to digital conversion, overview of performance of analog

TEXT BOOKS:

1. Electronic communications systems-Kennedy/TMH
2. Communications systems –Taub&Schilling/TMH

REFERENCE BOOKS:

1. Communication systems –Simon Haykins/John Wiley &sons
2. Communication systems-Bruce Carlson
3. Communication systems-Singh & Sapre/TMH

SEMESTER – VII
ELECTRICAL MACHINE DESIGN LAB

Course Code	**EE – 412(P)**		**L-0, T-0, P-3**
Name of the Course	**ELECTRICAL MACHINE – I LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 50**	**Min Pass Marks: 20**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30% Lab Record 25%, Viva 25% Attendance 20%**		**Max Marks: 50**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related
to the paper during the course of the semester.

LIST OF EXPERIMENTS

1.i) Study of winding arrangements for d.c.machines.
ii) Study of different winding arrangements of a.c.machines.

2. Design of the following machines to be worked out:
(i) Winding Design Drawing of DC/AC/synchronous Machines.
(ii) Design and drawing of single phase / three phase, core type / shell type transformers.
(iii) Drawing of the designed transformer using AUTOCAD.
(iv) Drawing of the designed DC machine using AUTOCAD.
(v) Design and Drawing of the armature winding of DC machine.
(vi) Design of DC machine.
(vii) Design and Drawing of AC machine.
(viii). Design and Drawing of Synchronous machine.

3. Following drawing sheets to be made:
(i) Transformer assembly views showing details of core assembly with windings in position and oil tank accessories.
(ii)Induction motors assembly views showing details of stator, rotor core, teeth winding in slot with insulation, shaft, bearing, covering, lifting eye bolts and terminal box.
(iii)Stator winding of an a.c. machine/armature winding of a d.c.machine (Induction or Synchronous)

TEXT BOOKS

1. A course in Electrical Machine Design by A.K.Sawhney.
2. Design Manual by Say and Smith

SEMESTER-VII
BIOMEDICAL ENGINEERING LAB

Course Code	**EE – 413(P)**		**L-0, T-0, P-2**
Name of the Course	**BIOMEDICAL ENGINEERING LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks:25**	**Min Pass Marks:10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30% Lab Record 25%, Viva 25% Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related
to the paper during the course of the semester.

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LIST OF EXPERIMENTS

(1) To study ECG Machine, pick-up ECG Signal, display it on CRO and find duration of P,R and T Wave.
(2) To Study various lead positions of ECG and observe the difference in ECG waveforms for different positions.
(3) To plot experimentally the relationship between the surface EMG and muscular force.

(4) To study various parts of an EEG Machine.

(5) To pick up EEG signals and study their wave patterns.

(6) To study the frequency spectrum of ECG signal on a display device using a movable band pass filter.

(7) To study the frequency spectrum of EMG on a display device using a movable band-pass filter.

(8) To study a C.T. Scan system available in the field.

(9) Study of pulse oximeter

Note: At least six experiments to be performed from above list.

SEMESTER – VIII
ELECTIVE – II (DEPTT.)
DIGITAL IMAGE PROCESSING

Course Code	**EEE – 421(a)**	L-3, T-1, P-0	
Name of the Course	**DIGITAL IMAGE PROCESSING**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section A:

Introduction:
Introduction to Digital image processing, Light and the electromagnetic spectrum, Image sensing and acquisition, Image sampling and quantization. Relationship between pixels, Linear and non linear operations.

Image Enhancement:

A. **In Spatial Domain:** Basic Gray level transforms, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
B. **In Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering, Properties of 2D Fourier Transform – Translation, Distributivity and Scaling, Rotation, Periodicity and conjugate symmetry, Separability.

Section B:

Image Restoration: A model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

Section C:

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Image Compression Standards.

Morphological Image Processing: Preliminaries, Dilation and Erosion, The Hit-or-Miss Transformation, Morphological Algorithms - Boundary Extraction,

Section D:

Image Segmentation: Detection of Discontinuities - Point Detection, Line Detection, Edge Detection. Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds. The Use of Motion in Segmentation.

Books Recommended:

1. Digital Image Processing, 2nd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education.
2. Fundamentals Of Digital Image Processing, by Anil K.Jain Publisher: PHI

References:

1. NPTEL video lectures

SEMESTER VIII
ELECTIVE – II (DEPTT.)
ADVANCED POWER ELECTRONICS

Course Code	**EEE – 421(b)**	L-3, T-1, P-0	
Name of the Course	**ADVANCED POWER ELECTRONICS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Advanced solid state devices such as MOSFETs, IGBT, GTO, IGCT, their power modules, intelligent power modules, thermal design, protection, gating circuits, digital signal processors used in their control.

Non-isolated dc-dc converters: Buck, boost, buck-boost, Cuk, SEPIC, Zeta in DCM and CCM. Isolated dc-dc converters: Flyback, forward, Cuk, SEPIC, Zeta, half bridge, push-pull and bridge in DCM and CCM. Single-phase, single-stage converters (SSSSC), power factor correction at ac mains in these converters. Their application in SMPS, UPS, welding and lighting systems.

Section-B

Improved power quality ac-dc converters such as single-phase buck, boost, buck-boost ac-dc converters, PWM (Pulse width modulated) based single-phase, three-phase VSC (Voltage source converters), multilevel VSCs, multipulse VSCs, PWM CSC (Current voltage source converters), multipulse ac-dc converters.

Section-C

Power quality mitigation devices such as passive filters, active filters, hybrid filters, DTSTCOM (Distribution static compensator), DVR (Dynamic voltage restorers) and UPQC (Universal power quality conditioners).

Section-D

Solid state controllers for motor drives such as vector control and direct torque control of induction motor, synchronous motor, permanent magnet sine fed motor, synchronous reluctance motor, permanent magnet brushless dc (PMLDC) motor, LCI (load commutated inverter) fed large rating synchronous motor drives, energy conservation and power quality improvement in these drives.

TEXT BOOKS:

1. N. Mohan, T. M. Undeland and W. P. Robbins, "Power Electronics, Converter, Application and Design", Third Edition, John Willey & Sons, 2004.
2. M. H. Rashid, "Power Electronics, circuits, Devices and Applications", Pearson, 2002, India.
3. B. K. Bose, "Power Electronics and Variable Frequency Drive", Standard Publishers Distributors, 2000.

REFERENCE BOOKS:

1. R. S. Ramshaw, "Power Electronics Semiconductor Switches", Champman & Hall, 1993.
2. Bin Wu, "High-Power Converters and AC Drives", *IEEE Press, A John Wiley & Sons, Inc Publication*, New York, 2006.
3. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, second edition, 1994, Avarua, Rarotonga, Cook Islands.
4. K. Billings, "Switch Mode Power Supply Handbook", McGraw-Hill, 1999, Boston.
5. A. I. Pressman, "Switch Mode Power Supply Design", McGraw-Hill, 1999, New York.

References:

1. NPTEL lectures

SEMESTER VIII
ELECTIVE – II (DEPTT.)
MICROWAVE ENGINEERING

Course Code	**EEE – 421(c)**	L-3, T-1, P-0	
Name of the Course	**MICROWAVE ENGINEERING**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section-A

Introduction: Microwave frequencies, microwave system, S-parameters and properties, Microwave hybrid circuits, waveguide tees, Hybrid rings, Directional couplers, Two hole directional couplers, S-Matrix of DC, Attenuators,, Cavity resonators, Phase shifter, Mixers and detectors, Ferrite devices: Microwave circulators and isolators and gyrators.

Section-B

Microwave solid-state devices: Gunn diode and its modes of operation, Avalanche diode, Tunnel diode, Schottky diode, Varactor diode, Backword diode,Step recovery diode,PIN diode, Read diode, MASER, IMPATT, TRAPATT,BARITT diodes(physical structure,basic operation and application only)

Section-C

Microwave Linear Beam Tubes: Limitation of conventional tubes, Construction, Operation and properties of Klystron Amplifier, Reflex Klystron, Traveling wave tube(TWT) and slow wave structure(Basic concept only) Microwave Cross field Tubes: Cylindrical, Linear Magnetron, Hartree condition, Coaxial magnetron,Voltage Tunable Magnetron.

Section-D

Microwave Measurements: Measurement of standing wave ratio, Measurement of frequency and wavelength, Measurement of power, Impedance measurement, Measurement of noise factor.
Strip Line: Micro strip lines, Parallel strip lines, Coplanar strip lines, Shielded strip lines, Characteristic impedance of micro strip lines, losses in micro strip lines, Quality factor of micro strip lines.

TEXT BOOKS:

1. Microwave devices and circuits: Samuel Y Liao, PHI.
2. Microwave Engineering: Annapurna Dass and S K Dass(3rd Edition Tata McGraw Hill).

REFERENCE BOOKS:

3. Microwave devices and Radar Engineering: M. Kulkarni, Umesh Publication.
4. Foundation for microwave engineering, international student edition, R.E.Collins.

SEMESTER-VIII

COMPUTER APPLICATION TO POWER SYSTEM ANALYSIS

Course Code	**EE – 422**	L-3, T-1, P-0	
Name of the Course	**COMPUTER APPLICATION TO POWER SYSTEM ANALYSIS**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

INTRODUCTION: System view point regarding Computer Aided Power Systems Analysis, Simulation, Single line diagram of power system, Review of power system parameters and representation, Analytical derivation of network matrices, formation of ZBUS and YBUS matrices, building algorithms.

SECTION-B

SHORT CIRCUIT STUDIES: Review of symmetrical components, Phase shift in star-delta transformer, Sequence Impedance of Transmission line, Transformer and Generators, Sequence Networks of power system. Transmission lines and loads. interconnection of sequence networks for three phase single line to ground, line to line, double line to ground and open conductor faults.

SECTION-C

POWER FLOW STUDIES: The power flow problem, power flow solution by Gauss – Siedal, Newton Raphson and Fast decoupled methods, Sparsity techniques, Control of power flow.

SECTION-D

TRANSIENT STABILITY STUDIES: The Swing equation, simplified synchronous machine model and system equivalents, equal area criterion, numerical integration of swing equation, multi machine stability, Design methods for improving transient stability.

TEXT BOOKS:

1. Modern Power System Analysis by I.J.Nagrath & D.P.Kothari.
2. Power System Analysis and Design with Personal Computer Application by J.D.Glover and M.Sharma, PWS – KENT Publishing Company.

REFERENCE BOOKS:

1. Computer Techniques to Power System Analysis by M.A.Pai.
2. Power System Analysis by J.J.Grainger and W.D.Steverson, MGH.
3. Electrical Power Systems by C.L.Wadhwa.
4. Power System Analysis and Design by B.R.Gupta.
5. Computer methods in power system analysis by G.W.Stagg and A.H.Li

SEMESTER-VIII
CONTROL ENGINEERING – II

Course Code	**EE – 423**	L-3, T-1, P-0	
Name of the Course	**CONTROL ENGINEERING - II**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION-A

State Variable Analysis: Introduction, concept of state, state variable and state model, state space representation of systems, block diagram for state equation, Transfer function decomposition, direct, parallel and cascade decomposition, solution of state equations, concept of controllability and observe ability.

SECTION-B

Sampled Data Control Systems: Introduction, digital control systems, quantization concept, data acquisition, conversion and distribution system, z-transform, important properties, inverse z-transform, difference equation and solution using z-transform.

SECTION-C

Impulse sampling and data hold, reconstruction of original signals from the sampled version, pulse transfer function for open loop and closed loop systems, mapping between z-plane and s-plane, stability analysis using Jury's test, bilinear transformation and Schur-Cohn criteria, state space representation of discrete time systems and solution of discrete time state equations.

SECTION-D

Non Linear Systems: Introduction, different non-linearity's, phase plane method, singular points, stability of nonlinear systems, construction of phase trajectories, phase plane method, concepts of describing function method, stability analysis using describing function method, jump resonance phenomena, Liapunov and Popov stability criterion.

TEXT BOOKS:

1. Discrete time Control Systems by K. Ogata, "Prentice Hall International".
2. Control System Engineering by Nagrath and Gopal, "New Age International".

REFERENCE BOOKS:

1. Digital Control Systems by B.C. Kuo "Oxford University Press".

SEMESTER-VIII
DIGITAL SIGNAL PROCESSING

Course Code	**EE – 424**	L-3, T-1, P-0	
Name of the Course	**DIGITAL SIGNAL PROCESSING**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39 for each semester)**		
Semester End Examination	Max. Time = 3 hrs.	Max. Marks: 100	Min. Pass Marks: 40
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max. Marks: 50**

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section A

Discrete – time signal analysis and linear systems: Signal analysis – signal characteristics – typical discrete – time signals – operation on signals – properties of linear time – invariant digital systems – Fourier transform relationship – sampling analog signals and sampling rate conversion. Z-transform; Properties of Z-transform-inverse, Z-transform – analysis of discrete time systems, convolution

Section B

Discrete Fourier transform (DFT) and inverse Discrete time Fourier Transform: properties – circular convolution. Fast Fourier Transform (FFT): Decimation-in-time (DIT) algorithm-decimation-in-frequency algorithm-FFT, Radix-2 DIT and DIF implementation

Section C

Digital filters: FIR Filters: Impulse response, Transfer function, Linear phase properties, Design: window Method , frequency sampling design chebyshev approximation Method. IIR Filters: Impulse response, Transfer function, Pole-zero representation; Butterworth, Chebyshev, inverse Chebyshev and elliptic filter concepts, Approximation problem for IIR filter design: Impulse in variance method, Bilinear transform method, Matched z-transform method, Minimum mean squared error method; Frequency transformations; Realization structures: Direct form 1 and 2.

Section D

Wavelet Transform

Short Time fourier Transform(STFT) , Wavelet Transform , Haar wavelet & multi resolution Analysis Dauvechies wavelets Application of wavelet transform

Digital Signal Processors: Architecture and types of instructions, Addressing schemes and Interface details of one of the latest, commonly used Digital Signal Processors (e.g. Digital Signal Processors manufactured by Texas Instruments or Analog Devices.)

TEXT BOOKS:

1. Oppenheim A. V., Schafer R. W., "Discrete-Time Signal Processing," Prentice Hall India, 1996.
2. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications," Prentice Hall of India Pvt. Ltd., 1997.

REFERENCE BOOKS:

1. Digital Signal Processing –Shaila D. Apte- 2nd Edition Wiley India edition
2. Digital Signal Processing –Thomas J. Cavicchi- 2nd Edition Wiley India edition
3. Boaz Porat, "A Course in Digital Signal Processing," Prentice Hall Inc, 1998.
4. Chi-Tsong Chen, "Digital Signal Processing: Spectral Computation and Filter Design," Oxford University Press, 2001.

SEMESTER-VIII
COMPUTER APPLICATION TO POWER SYSTEM ANALYSIS LAB

Course Code	**EE – 421(P)**		**L-0, T-0, P-2**
Name of the Course	**COMPUTER APPLICATION TO POWER SYSTEM ANALYSIS LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 50**	**Min Pass Marks: 20**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 50**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related
to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. To study E-tap software
2. To study and draw a single line diagram of power system
3. Symmetrical fault level analysis of a multi-bus power system using soft-techniques.
4. Unsymmetrical fault level analysis of a multi-bus power system using soft-techniques for single line-to-ground faults.
5. Unsymmetrical fault level analysis of a multi-bus power system using soft-techniques for double line-to-ground faults.
6. Unsymmetrical fault level analysis of a multi-bus power system using soft-techniques for line-to-line faults.
7. Software Development for Load Flow study of power system using Gauss-Siedal Method.
8. Software Development for Load Flow study of power system using Newton-Raphson Method.
9. Software Development for Load Flow study of power system using Fast-Decoupled Method

Note: Atleast perform 6 experiments from above list.

SEMESTER-VIII
DIGITAL SIGNAL PROCESSING LAB

Course Code	**EE – 424(P)**		**L-0, T-0, P-2**
Name of the Course	**DIGITAL SIGNAL PROCESSING LAB**		
Lectures to be Delivered	**26 Hrs. of Lab work (2hrs. each per week)**		
Semester End Examination	**Max Marks: 25**	**Min Pass Marks: 10**	**Maximum Time: 3 hrs**
Continuous Assessment	**Lab work 30%** **Lab Record 25%,** **Viva 25%** **Attendance 20%**		**Max Marks: 25**

Instructions for Paper setter/ Candidates

Laboratory examination will consist of two parts:
1. Performing a practical examination assigned by the examiner (25 marks)
2. Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical's performed/projects executed by the candidate related to the paper during the course of the semester.

LIST OF EXPERIMENTS

1. Write a program for linear convolution of two sequences.
2. Write a program for circular convolution.
3. Write a program to perform linear convolution using circular convolution.
4. Write a program to perform N-point DFT. Also perform the IDFT on the result obtained to verify the result.
5. Write a program to perform circular correlation using
6. Direct method b) circular convolution using rotation method.
7. Write a program to perform circular convolution and correlation using DFT.
8. Write a program to perform linear convolution using (a) overlap save method (b) overlap add method.

9. Write a program to perform FFT on a sequence using the following methods. (a) Decimation in time (b) Decimation in frequency
10. Write a program to perform IDFT on a transformed sequence using DFT.
11. Write a program to design an FIR filter using windowing technique.
12. Write a program to design an IIR filter using (a) impulse invariant method (b) bilinear transformation method.

Note: At least perform 8 experiments from above list.