INDIRA GANDHI NATIONAL OPEN UNIVERSITY
SCHOOL OF ENGINEERING AND TECHNOLOGY
MAIDAN GARHI, NEW DELHI-110 068

Programme Structure of
Vertically Integrated Engineering programmes

Level of Programme : Degree
Discipline : Electrical Engineering

PROGRAMME CODE : BTELVI

First Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	ET-101A	**Mathematics-I**	4	4	
2.	ET-105A	**Physics**	4	4	
3.	BAS-003	**Communication Skills**	3	3	
4.	ET-202A	**Engineering Mechanics**	4	4	
5.	BAS-005	**Engineering Drawing**	3	3	
6.	BASL-001	**Lab-I (Applied Science)**	1	2	
7.	BASL-002	**Lab-II (Engineering Mechanics)**	1	2	
		TOTAL	20	22	

Second Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	BIEL-001	Basics Of Electronics Engineering	4	4	
2.	BME-003	**Manufacturing Technology**	4	4	
3.	BICE-001	**Elements of Engineering Science**	4	4	
4.	BIEE-003	Power Systems-I	4	4	
5.	BIEE-004	Electrical machines-I	4	4	
6.	BIEEL-001	Lab-IV (Electrical machines-I)	1	2	
7.	BASL-003	**Lab-III (Workshop Practice)**	1	3	
		TOTAL	22	25	

Third Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	ET-101B	**Mathematics-II**	4	4	
2.	BME-009	**Computer Programming and Applications**	4	4	
3.	BME-017	**Strength of Materials**	4	4	
4.	ET-524A	**Principles of Engineering Management and Economics**	4	4	
5.	BIEE-005	Electromagnetic Theory	4	4	
6.	BASL-006	**Lab-V (Computer Programming)**	1	2	
7.	BIMEL-002	**Lab-VI (Strength of Materials)**	1	2	
		TOTAL	22	24	

Fourth Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	BICE-007	Mathematics-III	4	4	
2.	BIEE-007	Electrical Measurements and Measuring Instruments	4	4	
3.	BIEE-008	Eectro-Mechanical Energy Conversion-I	4	4	
4.	BIEE-009	Applied Electromagnetic	4	4	
5.	BIEE-010	Micro Controller	4	4	
6.	BIEEL-003	Lab-VII(Electrical Measurements)	1	2	
7.	BIEEL-004	Lab-VIII(EMEC-I)	1	2	
8.	BIEEL-005	Lab-IX(Micro Controller)	1	2	
		TOTAL	23	26	

Fifth Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	BIEE-011	Electrical Machines-II	4	4	
2.	BIEE-012	Electro-Mechanical Energy Conversion-II	4	4	
3.	BIEE-013	Electrical and Electronics Engineering Materials	4	4	
4.	BIEE-014	Network Theory	4	4	
5.	BIEE-015	Microprocessor and Its Applications	4	4	
6.	BIEEL-006	Lab-X(Electrical Machines-II)	1	2	
7.	BIEEL-007	Lab-XI(EMEC-II)	1	2	
8.	BIEEL-008	Lab-XII(Network)	1	2	
		TOTAL	23	26	

Sixth Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	BIEE-016	Electro-Mechanical Energy Conversion-III	4	4	
2.	BIEE-017	Digital Electronics	4	4	
3.	BIEE-018	High Voltage Engineering	4	4	
4.	BIEE-019	Electrical Instrumentation	4	4	
5.	BIEE-020	Electrical Machines And Electronics	4	4	
6.	BIEEL-009	Lab-XIII(Digital Electronics)	1	2	
7.	BIEEL-010	Lab-XIV(Electrical instrumentation)	1	2	
		TOTAL	22	24	

Seventh Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	**BIEE-021**	**Control Systems**	**4**	**4**	
2.	**BIEE-022**	**Power Systems**	**4**	**4**	
3.	**BIEE-023**	**Switch Gear Protection**	**4**	**4**	
4.	**-**	**Elective-I**	**4**	**4**	
5.	**-**	**Elective-II**	**4**	**4**	
6.	**BIEEL-011**	**Lab-XV(Control Systems)**	**1**	**2**	
7.	**BIEEL-012**	**Lab-XVI(Power Systems)**	**1**	**2**	
8.	**BIEEP-003**	**Project**	**-**	**4**	
		TOTAL	**22**	**28**	

Eighth Semester

Sl. No.	Course Code	Course Description	Credit	Load per Week	Remarks
1.	**BIEE-024**	**Power Electronics**	**4**	**4**	
2.	**BIEE-025**	**Power System Planning and Load Forecasting**	**4**	**4**	
3.	**BIEE-026**	**Energy Auditing and Analysis**	**4**	**4**	
4.	**-**	**Elective-III**	**4**	**4**	
5.	**-**	**Elective-IV**	**4**	**4**	
6.	**BIEEL-013**	**Lab-XVII(Power electronics)**	**1**	**2**	
7.	**BIEEP-003**	**Project**	**8**	**4**	
		TOTAL	**29**	**26**	

The students have to choose any two subjects as Elective-I, II from the following (VII Semester)

Sl. No.	Course Code	Course Description	Credit	Load per Week
1	BIEEE-001	**Dynamic system simulation**	4	4
2	BIEEE-002	**Digital Control Systems**	4	4
3	BIEEE-003	**Special Electrical Machines**	4	4
4	BIEEE-004	**Mechatronics**	4	4
5	BIEEE-007	**Computer application in power systems**	4	4
6	BIEEE-008	**Flexible AC Transmission System**	4	4
7	BIEEE-009	**Digital Control System Design**	4	4
8	BIEEE-010	**Power System Reliability**	4	4

The students have to choose any two subjects as Elective-III, IV from the following (VIII Semester)

Sl. No.	Course Code	Course Description	Credit	Load per Week
1	BIEEE-011	**Electric Energy Utilization**	4	4
2	BIEEE-012	**Active Filter Design**	4	4
3	BIEEE-013	**Power Quality Issues And Remedial Measures**	4	4
4	BIEEE-014	**Computer Control Process**	4	4
5	BIEEE-015	**Stochastic Control Systems**	4	4
6	BIEEE-016	**Industrial Drives**	4	4
7	BIEEE-017	**Advanced Control Systems**	4	4
8	BIEEE-018	**Advanced Power Electronics**	4	4

PLEASE NOTE

1. **There may be some compulsory subjects / elective subjects / project where the subject codes may be missing. The codes will be uploaded shortly.**

2. **For further references and supportive study material please visit**
   http://nptel.iitm.ac.in/

ET-101A- MATHEMATICS-I

Lectures	Tutorials	PRACTICAL	Credits	Marks
4	**----**	**--**	**4**	External:70+Internal:30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1:

DIFFERENTIAL CALCULUS: Functions of One Variable, Limit, Continuity and Differentiability, Mean Value Theorems, Applications, Partial Differentiation.

UNIT 2:

INTEGRAL CALCULUS: Indefinite Integrals, Definite Integrals, Applications**,** First Order Differential Equations.

UNIT 3:

VECTOR CALCULUS: Vector Algebra, Vector Differential Calculus, Line and Surface Integrals, Volume Integral

UNIT 4:

MATRICES: Linear Equations and Euclidean Spaces, Linear Transformation and Linear Equations, Matrices and Determinants, Eigenvalues and Eigenvectors, Canonical Forms.

References:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2 Advanced Engineering Mathematics by Erwin kreyszig (Wiley Eastern-Ltd).
3. Higher Engineering Mathematics by B.S. Grewal (Khanna Publication, Delhi).
4. Applied Mathematics (Volumes I and II) by P.N. Wartikar & J.N. Wartikar
5. Advanced Mathematics, 7e, by Peter V. O'Neil (Thomson Learning).
6. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).

ET-105A-PHYSICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External:70+Internal:30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1:

PARTICLE MECHANICS: Dynamic of a Particle, Linear and Angular Momentum, Energy,The Inverse Square Law.

UNIT 2:

ROTATIONAL DYNAMICS: Systems of Particles**,** Moment of Inertia and Fixed Axis Rotation**,** Rotation of Rigid Bodies

UNIT 3:

OSCILLATIONS AND WAVES: Oscillations, Waves, Superposition of Waves, Interference and Differaction, Polarisation.

UNIT 4:

ELECTRICITY: Electric Field, Gauss's Law, Electric Potential and Capacitance, Electric Circuits.

Unit 5:
Electromagnetism: The magnetic field, Lorentz force, Faraday's Law, Electromagnetic waves.

Reference:

1. University Physics, Young and freedman (Pearson Education).
2. Fundamentals of physics, Resnick and Halliday (John Wiley and sons).
3. Principles of physics, Serway and Jewett (Saunders college publishing).
4. Engineering Physics, R.A.Gaur & S.L.Gupta(Dhanpat rai Publications)

BAS-003 COMMUNICATION SKILLS

Lectures	Tutorials	PRACTICAL	Credits	Marks
4	----	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Essentials of Grammar: Parts of Speech, Punctuation, Vocabulary Building, Phonetics. Office Management : Types of Correspondence, Receipt and Dispatch of Mail, Filing Systems, Classification of Mail, Role & Function of Correspondence, MIS, Managing Computer.

UNIT II

Letter & Resume Writing: Types of Letters-Formal / Informal, Importance and Function, Drafting the Applications, Elements of Structure, Preparing the Resume, Do's & Don'ts of Resume, Helpful Hints

UNIT III

Presentation Skills: Importance of Presentation Skills, Capturing Data, Voice & Picture Integration, Guidelines to make Presentation Interesting, Body Language, Voice Modulation, Audience Awareness, Presentation Plan, Visual Aids, Forms of Layout, Styles of Presentation.

UNIT IV

Interview Preparation: Types of Interview, Preparing for the Interviews, Attending the Interview, Interview Process, Employers Expectations, General Etiquette, Dressing Sense, Postures & Gestures

UNIT V

Group Discussion & Presentation: Definition, Process, Guidelines, Helpful Expressions, Evaluation

The student will be evaluated on the basis of:

1 His / Her presentation style
2 Feedback of Faculty & Students
3 General Etiquette
4 Proficiency in Letter Drafting / Interview Preparation
5 The paper is internal and at least 3 tests will be taken. Best 2 of 3 shall account for final grades (70% Test & 30% Presentation)

References:

1. Shiv Khera, "YOU CAN WIN", Macmillan Books. 2003 revised edition.
2. Stephen Covey, "7 Habits of highly effective people"
3. John Collin, "Perfect Presentation", Video Arts MARSHAL.
4. Jenny Rogers, "Effective Interviews", Video Arts MARSHAL.
5. Raman, Sharma, "Technical Communications", OXFORD.
6. Sharon Gerson, Steven Gerson", Technical Writing process and product", Pearson education Asia, LPE Third Edition.

7. R Sharma, K. Mohan, "Business correspondence and Report writing" , Tata McGraw-Hill ISBN 0-07-044555-9
8. Videos for Technical Education Catalog, National Education and Information Films Ltd, Mumbai.

ET-202A: ENGINEERING MECHANICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1:

STATICS: Coplanar and Non-coplanar Forces, Equilibrium: Free Body Diagram, Friction, Centre of Gravity and Moment of Inertia.

UNIT 2:

DYNAMICS: Kinematics, Kinematics of a Particles, Kinematics of Rigid Bodies, Impulse, Momentum, Work and Energy.

UNIT 3:

INTRODUCTION TO STRUCTURAL MECHANICS: Axial Force, Shear Force and Bending Moment Diagrams, Plane Trusses, Simple Stresses and Strains.

Reference:

1. Engineering Mechanics by S. Ramamrutham, Dhanpat Rai Publishing Company.
2. Engineering Mechanics statics and dynamics by R. C. Hibbeler McMillan Publication.
3. Mechanics for Engineers- Statics fourth Edition by F. P. Beer and E. R. Johnson, McGraw-Hill Publication.
4. Mechanics for Engineers- Dynamics Fourth Edition, by F.P. Beer and E. R. Johnson, McGraw- Hill Publication.
5. Engineering Mechanics statics and dynamics by J.L. Meriam and Craige, John Willey and Son's publication.
6. Engineering Mechanics by S.S. Timoshenko and D.H. Young, McGraw Hill Publication.
7. Engineering Mechanics by A.P. Boresi and R.J. Schmidt, Brooks/Cole Publication.
8. Engineering Mechanics by FL Singer, Harper and Rowe publication.
9. Engineering Mechanics by Shames I.H., PHI

BAS-005 Engineering Drawing

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	---	--	3	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Introduction to Drawing - Drawing Equipments and Instruments, Drawing Sheet and Layout, Types of Letters and Lettering Standard, Types of Lines and Their Applications, Dimensioning of Drawing, Drawing Scales, Conventional Representation

UNIT II

Geometrical Construction – Triangle, Square, Polygon, Pentagon, Hexagon, Circle and Curves, Conic Sections, Ellipse, Parabola, Hyperbola, Cycloid, Epicycloids, Hypocycloid, Tangent and Normal to Curves

UNIT III

Orthographic Projections I - Orthographic Projection, Projection of Points, Projection of Straight Lines, Projection of Planes, **Orthographic Projections-II -** Types of Solid, Orthographic Projections of Solid, Orthographic Projections of Solid when the Axis is Perpendicular to one of the Principal Plane, Orthographic Projections of Solid when the Axis is Parallel to Both the H.P. and V.P., Orthographic Projections of Solid when the Axis is Inclined to One of the Principal Plane and Parallel to the Other Principal Plane, Orthographic Projections of Solid when the Axis is Inclined to both the Principal Plane, Sections of Solids

UNIT IV

Isometric and Oblique Projections - Classification of Pictorial Drawings, Isometric Projection, Isometric Drawings of Plane Geometrical Figure, Isometric Projection of Solids, Oblique Projection

UNIT V

Surface Development - Geometric Objects, Development of a Surface, Development of a Cube, Development of a Tetrahedron, Development of an Octahedron, Development of a Prism, Development of a Pyramid, Development of a Cylinder, Development of a Cone, Development of a Sphere.

Unit VI

I.S. Conventions Need and Types, conventions existing in countries like Japan, US and Germany.

Unit VII

Standard Machine Components and their I.S. Conventions Constructional features & Applications of standard machine components like Nuts, Bolts, Screws, Spring etc.

Reference

1. N.D. Bhatt, Elementary Engineering Drawing, Chartor Publishing house, Anand, India.
2. D. N. Johle, Engineering Drawing, Tata Mcgraw-hill Publishing Co. Ltd.
3. K. L. Narayana and P. Kannaiah, Machine Drawing New Age International Ltd
4. P.S. Gill, Engineering Graphics.
5. James H. Earle, Engineering Design Graphics, Addison-Wesley Publishing Co.
6. David I. Cook and Robert N. McDongal Engineering Graphics and Design with Computer Applications Holt-Sounders International Editors
7. IS Code SP 46
8. Warren J. Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi.
9. Fredderock E. Giesecke, Alva Mitchell & others, Principles of Engineering Graphics, Maxwell McMillan Publishing
10 Siddheshwar, Machine Drawing, Tata-McGraw Hill.
11. N. D. Bhatt, Machine Drawing, Charotar Publishing Company

BASL-001: Lab-I (Applied Science)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

List of PRACTICAL (Students are required to conduct ANY 8 Experiments out of the following 10 Experiments).

1. Use of diffraction grating for the determination of wavelength of a spectral line.
2. Newton's rings experiment. (Wavelength, radius, refractive index, determination)
3. Experiment based on ultrasonic waves.
4. Resolving power of a Telescope/Grating.
5. Determination of refractive indices for ordinary, extraordinary rays for a Quartz crystal! Prism.
6. Demonstration of Lissajous figures using a CR0 (Principle of Interference).
7. Michelson's Interferometer.
8. Determination of Brewster's angle for glass surface and to determine refractive index of Glass.
9. Determination of Youngs Modulus by Cornu's method.
10. To verify cosine square law of Malus for plane polarized light using photo-voltaic cell

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BASL-002 : LAB-II (Engineering Mechanics)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total..

List of PRACTICAL in Applied Mechanics (**Any Eight out of the following**)

1) To determine the verification of law of polygon of force.

2) To determine the funicular polygon

3) To determine the Finding coefficient of friction by inclined plane apparatus

4) To determine the Mechanical, Advantage, Velocity ratio & efficiency of a

(a) Simple purchase crab winch

(b) Double purchase crab winch

(c) Gear train etc.

(d) Wheel and axle

(e) Screw Jack

5) To determine the finding forces in members of a cantilever truss

6) To determine the finding forces in members of a general truss

7) To determine the moment of inertia of a flywheel

8) To determine the Example modulus by Searle's apparatus,

9) To determine the MA, VR & n of a differential pulley block, warm & warmed

10) To determine the finding expertly Reactions in a Beam

11) To determine Graphically evaluation of forces in a truss

12) To determine the Graphically evaluation of CG of a plane figure

13) To determine the graphically evaluation MI of a plane figure.

BIEL-001:Basics of Electronics Engineering

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal:30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Band theory of solids - Conductors, semiconductors and insulators - energy band diagram. – Semi conductor materials and their properties: elemental semiconductors- the energy band model of semiconductors. Valance band model of semiconductor equilibrium concentration of electrons and holes- the Fermi level and energy distribution of carriers inside the bands- temperature dependence of carrier concentration inside the bands. - Carrier transport in semi conductors - drift of carriers in electric fields, carrier flow by diffusion - constancy of Fermi level across junction , Excess carriers in semi conductors - injection of excess carriers - recombination of excess carriers – continuity equation - current flow equation.

UNIT II

PN junction- Abrupt PN junction - energy band diagram - barrier potential, biasing PN junction, excess carrier calculation - current components diffusion - drift - boundary conditions for long and short diodes - PN junction characteristics - calculation of diffusion – depletion layer capacitance - simple model - principle of zener and avalanche diodes - photodiodes -LDR - tunnel diode and PIN diode -varactor diode.

UNIT III

Bipolar junction transistors - NPN, PNP types , Basic structures - biasing - mechanism of carrier flow - current components in transistors boundary conditions in active region - solution for short base width - basewidth modulation - Transistor configurations - Characteristics – current amplification factors - relations between alpha & beta - comparison Ebbers - Moll model – Field effect transistors : JFET - basic structures - principle of operation - Characteristics and current equation - basic principles of phototransistors - UJT, characteristics.

UNIT IV

MOSFET - semiconductor surfaces - C - V characteristics - the Si - SiO2 System - basic structures and operating principles - current equation - V-I characteristics - simple model - CMOS. Compound semiconductor - semiconductor heterojunctions - V-I characteristics - real heterojunctions - frequency limitation of transistor - transit time effect - heterojunction bipolar transistor.

UNIT V

DC power supplies - power transformers - rectification - half wave, full wave, bridge – expression for ripple factor, efficiency, comparison, diode ratings. Filters - capacitor - inductor LC filters- use of bleeder resistor - voltage multipliers - dual power supplies - simple voltage regulator. Series regulators - IC regulators.

REFERENCE BOOKSs:

1) Streetman, "Solid State Electronics Devices", Pearson Education
2) "Electronic Devices ", Floyd
3) Electronic Devices & Circuits, Millman & Halkias
4) Solid state Electronics IVth edition, George B Rutkowski, Mc Graw Hill

BME 003: MANUFACTURING TECHNOLOGY

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	---	--	3	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1: PRINCIPLE OF METAL CASTING: Metals and Melting Practices, Moulding Materials, Moulding Processes.

UNIT 2: METAL FORMING: Plastic Deformation**,** Bulk Deformation**,** Sheet Metal Forming Process.

UNIT 3: PRINCIPLES OF METAL CUTTING: Tool Geometry, Force & Power Requirement**,** Cutting Conditions**,** And Machining Economics.

UNIT 4: WELDING TECHNOLOGY: Welding Processes**,** Welding Stresses, Distortion and Defects.

References:

1. S. K. Hajra Choudhury, Bose S.K., Elements of Workshop technology, Vol-I, Manufacturing Process, Media Promoters and Publishers Pvt Ltd.
2. B.S. Raghuwansi, A Course in Workshop Technology, Vol-I, Dhanpat Rai and Co.(P) Ltd Delhi.
3. K.C. Arora, Workshop Practice, S.K, Kataria and Sons.
4. R.K. Singhal, Workshop Practice, S.K. Kataria and Sons.
5. P.N. Rao Manufacturing Technology Vol I & II, Tata McGraw Hill Publishers.
6. P.C. Sharma, Production Engineering, Khanna Publishers.
7. R.K. Jain, Production Technology, Khanna Publishers
8. HMT. Production Technology, Tata McGraw Hill Publishers
9. Hoffman, Introduction to Jigs and Fixtures, Galagotia Publishers
10. S.K. Basu, Fundamentals of Tool Design, Oxford IBH
11. Degarmo, Black and Kosherth, Materials and Processes in Manufacturing 8th Edition Prentice Hall of India.

BICE-001:Elements of Engineering Science

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Basic concepts: Concept of electricity, Basic terms- Voltage current, Potential Difference, Power, energy and their units. Ohm's Law Effect of temperature on resistance, temperature coefficient of resistance. Resistances in series and parallel Kickoff's current law and Kickoff's voltage law and their applications to simple circuits. Various unit systems. Conversion of energy theory. Conversion of one form of energy units into electrical and electrical to another form of energy. Work + Power + Energy concepts. Numerical based on work power energy.

UNIT II

Introduction to Civil Engineering: Basic Areas in Civil Engineering. Roll of civil engineer as site engineer, Roll of civil engineer at different levels of project (such as consultant, as contractors, as specialized), different types of building and it s various components

UNIT III

Principles of survey, plan, map, plain scale, R.F. sign conventions Use of tapes for distance measurement, Ranging-by eye and with line ranger. Concepts of base line, tie line, check line, offsets using open cross staff Study of prismatic compass. Types of bearings and reference meridians. Measurement of bearings and angles Local attraction and its adjustment.

UNIT IV Thermodynamics -Thermodynamics types, system, surrounding work, p-dV work in various processes, p-V representation of various thermodynamic processes and cycles, Ideal gas equations, Statements of I and II laws of thermodynamics ,Carnot cycle for Heat engine, Refrigerator and Heat pump.
Heat Transfer Statement and explanation of Fourier's law of heat conduction, Newton's law of cooling, Stefan Boltzmann's law.
I.C. engines-important parts and working of 2s and 4s petrol and diesel engines.

UNIT V

Design- design process and design cycle, stress and strain and their types, Hooke's law, stress strain curve for ductile and brittle materials, mechanical properties of materials, steels, cast irons, non- ferrous alloys.
Introduction to manufacturing processes and Their Applications:
Casting, Sheet metal forming, Sheet metal cutting, Forging, welding and soldering processes.

Machine Tools (Basic elements, Working principle and types of operations)-Lathe Machine – Centre Lathe, Drilling Machine –radial drilling machine, Grinding machine, Power saw, Milling Machine

References:

1.Electrical Technology Vol – 1 – B.L. Theraja & A.K.Theraja – S. Chand

2.Basic Electrical Engineering – Nagrath Kothari – TMH

3.Basic Electrical Engineering – V.K.Mehata – S Chand

4.Basic Electrical Engineering – Vaidya, Bhagwat, Godbole, Bangal

5.Surveying and Leveling---Kanetkar and Kulkarni, PVC Prakashana

6.Thermal engineering by Khurmi –Gupta

7.Design of machine elements by Bhandari.

8.Manufacturing processes by Amitabh Ghosh- Mallik.

9.Production technology by R.K.Jain.

BIEE-003: POWER SYSTEM-I

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1

Function of electric systems, transmission of power by different systems, influence of voltage on cost and efficiency, comparison of different systems of transmission, types of conductors and spacing of conductors, consants of overhead transmission lines: Main parameters of overhead transmission lines, resistance of conductor, skin and proximity effect, calculation of inductance and capacitance of single phase and three phase lines with equal and unequal spacing for single and bundle conductors, application of GMD, GMR methods.

UNIT 2

Representation and performance of short, medium and long lines ABCD constants, power circle diagrams, static and synchronous phase modifiers, surge impedance loading of transmission lines, efficiency, regulation and phasor diagrams of transmission lines, Ferranti effect . Phenomenon of corona, potential gradient, break down voltages, corona power loss, effect of atmospheric conditions, Radio interference phenomenon: General effect of positive and negative polarities as well as of a.c. and D.C. supplies on corona. Methods to improve corona performance.

UNIT 3

Mechanical Design of Transmission Lines: Main considerations in the design of transmission lines, calculation of sag, variation of sag with load and temperature, stringing chart, sag template, uplift in insulator string, earth wires, type of towers, vibration dampers, line supports, spacing of conductors and guards. Type of insulators, voltage distribution on suspension insulators string, string efficiency, shielding and grading.

UNIT 4

Types of distribution system and their application, calculation of size and voltage drop. Feeders Kelvin's law and modified Kelvin's law for feeder conductor size, limitations of Kelvin's laws. Comparison of cables and overhead lines, types of cables, insulation resistance, stress and capacitance of single and multicore cables, charging current, grading of cables, sheath effects, dielectric loss, power factor thermal resistance.

1) Electric Power Systems: By- C.L.Wadhwa

2) Electric Power Systems: By- Asfaq Hussain

3) Electric Power Systems: By- S.L.Uppal

4) Elements of Power System Analysis: By- William D.Stevenson

5) Power System Analysis & Design: By –B.R.Gupta

6) HVDC Transmission: By K.R.Padiyar

BIEE-004: **ELECTRICAL MACHINES-I**

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal:30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1

D.C.Machines: Construction, principal of operation, Emfquation, torque equation. Armature winding –Lap, wave, single layer, double layer. Armature reaction and commutation, method of improving commutation.

UNIT 2

D.C.Generators: Types, Characteristics and application of d.c.shunt, series and compound generators. Parallel operation of d.c. shunt, series and compound generators. Introduction for conducting and reporting the test on D.C. machines as per Indian standard.

UNIT 3

D.C.Motors: Characteristics, applications of d.c. shunt series and compound motors, starting and speed control, losses, efficiency and testing

UNIT 4

Single phase Transformer: Heat run test, separation of core losses in to its component, parallel operation, equivalent circuit. Autotransformer- Construction, working, merits, demerits and application. Introduction for conducting and reporting the test on transformer as per Indian standard.

UNIT: 5

Three Phase Transformer: Construction, working, types, connections, applications, testing, parallel operation, open delta, power transformer, distribution transformer construction. Three phase to single phase, two phase, six phase, and twelve phase conversion. Three winding transformer and tap changing transformer. Wave forms of no-load current and inrush current phenomenon.

RECOMMENDED BOOKS

1) Electrical Engineering Vol.I: Direct current by C.Dawes IV Edition.

2) Electrical Machinery by Nagrath, Kothari (Tata Mc GrawHill)

3) Electrical Machine by P.S.Bhimra.

4) Advance Electrical Technology by H.Cotton (Wheeler Publication)

5) Substation Equipment by Satnam and Gupta.

6) Theory of AC Machines by Langsdorf (Tata McGraw-Hill)

7) Principles and practice of Electrical Engineering by Gray Wallance (International student Ed. VIII Ed.)

8) Performance and design of d.c.machines by Claytonand and Hancokk.

9) Indian Standard Guide for testing DC Machine. IS: 9320-1979, By Indian Standards Institution, New Delhi

10) Indian Standard Specification for safety transformer. IS:1416-1972

BIEEL-001: ELECTRICAL MACHINES-I LAB

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

LABORATORY EXPERIMETNS

Any eight experiments from the list given below

1. Speed control of dc shunt motor (i) Armature control method (ii) field control method
2. Determination of efficiency of DC motor by swinbuns test
3. Determination of efficiency of DC motors by Hopinkinson.s test
4. Break test on shunt motor
5. Field test on series motor
6. Load test on compound motor I) cumulative ii) differential
7. To perform open circuit and short circuit test for determining equivalent circuit parameter of a single phase transformer
8. Parallel operation of a singal phase transformer
9. Scott Connection
10. Equivalent Delta test or Heat runs Test for three phase transformer
11. DY1 and DY11 parallel and connection
12. load test on transformer (single and three phase)
13. Polarity test on transformer (single and three phase)

BASL-003: LAB-III (Workshop Practices)

Lectures	Tutorials	PRACTICAL	Credits	Marks
	----	3	2	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Term Work

Here PRACTICAL of workshop practice must be conducted in such a way that each student must be able to independently make objects / products which are commercially marketable and useful to college or society as whole. Instructor must demonstrate making of at least one job from each category.

Students are expected to learn ANY FOUR out of the following skills and must get acquainted to the tools used and standard procedure used as applicable.

Term Work should include

1. **Carpentry** – One job on wood joints like lap joint, mortise & tendon joint etc. The job may be making a stool. Demonstration of one job on wood turning operation.
2. **Sheet Metal –** One job on sheet metal which must contain making any of the following- tray or dustbin.
3. **Fitting –** One simple job on male female joint which includes drilling and tapping operations.
4. **Smithy and Forging** – One job on forging such as
   a. Making one end of the flat bar knife edge and other end vee.
   b. Making nails or arrows for surveying, fixing cricket mat etc.
   c. Making tools used in gardening.

5. **Plumbing –** One job on pipe joints. Dummy piping system may be used to explain Piping joints.

   Students may be shown industrial or domestic piping so as to understand the need of Piping.

6. **Welding-** One job on arc welding joints like lap, butt, T joints and one job on gas welding.

Journal should include report on process sheets of all jobs, description of hand tools & equipments used, various operations performed, safety precautions in workshop. Instructor must introduce all important parameters of process. At least one demonstration of making of each job must be shown to students. Finally appropriate marks may be awarded by evaluating the performance of the student**.**

ET-101 (B): MATHEMATICS-II

Lecture	Tutorial	PRACTICAL	Credit	Marks
4	**0**	**--**	**4**	External: 70+Internal:30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1: PROBABILITY CONCEPTS: Introduction to Probability, Theorems of Probability, Discrete Distributions.

UNIT 2: DISTRIBUTION THEORY: Continuous Distributions**,** Multivariate Distributions**,** Sampling Distributions and Approximations of Distributions.

UNIT 3: ESTIMATION AND TESTS OF HYPOTHESIS: Point Estimation**,** Interval Estimation and Testing of Hypothesis**,** Standard Statistical Tests.

Reference:

1. Meyer, P.L, Introduction to Probability and Statistical Applications Addition-Wesley Publishing company.
2. Trivedi, K.S, Probability and Statistics with Reliability, Queuing and Computer Science Applications. Prentice Hall of India Ltd, New Delhi.
3. Introduction to probability and Statistical Applications, P.L. Meyer
4. An Outline of Statistical Theory, Vols. I & II by Goon, Gupta and Dasgupta.
5. Introduction to probability and Statistical Applications by Paul L. Meyer
6. An Outline of Statistical Theory, Vol. I & II by Goon Gupta and Guptadas.

BME-009: COMPUTER PROGRAMMING AND APPLICATION

Lecture	Tutorial	PRACTICAL	Credit	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Block 1 : Basics of C++

Unit 1 : Programming Constructs

Unit 2 : Arrays and Pointers

Unit 3 : Function and Structures

Block 2 : Object Oriented Programming Using C++

Unit 4 : Objects and Classes

Unit 5 : Virtual Functions

Unit 6 : Programming Examples

Block 3 : Numerical Methods

Unit 7 : Number Representation and Errors

Unit 8 : Methods for Finding Roots of Equations

Unit 9 : Direct Methods of Solution for System of Equations

Unit 10 : Iterative Method of Solution of Equation

Unit 11 : Finite Difference Interpolation

Unit 12: Introduction to MSTLAB/Mathematica

References:

1. Programming in ‘C’ , Balagurusamy Tata Mc-Graw Hill
2. Let’s ‘C’, Kanetkar BPB.
3. Complete reference in C, Herbert Shildt, Tata Mc-Graw Hill

4. Numerical Methods: Using C, Fourth Edition , 2004, John H. Mathwes and Kurtis D. Fink,Prentice Hall Publications.

BME 017: STRENGTH OF MATERIALS

Lecture	Tutorial	PRACTICAL	Credit	Marks
3	1	--	4	External: 70+Internal:30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1: STRESSES IN SOLIDS: Simple Stresses and Strains**,** Thermal Stresses**,** Principal Stresses and Strains.

UNIT 2 : FORCES AND STRESSES IN BEAMS: Shear Forces and Bending Moments**,** Stresses in Beams**,** Stress Distribution in Beams**,** Direct and Bending Stresses**,** Strain Energy

UNIT 3: STRESSES IN SHAFTS AND SHELLS AND THERMAL STRESSES: Deflection of Beams**,** Torsion**,** Thick and Thin Cylinders**,** Shells**,** Springs

Reference:

1. Rajput. R.K.'' Strength of Materials'' S. Chand & co Lt. New Delhi 1996
2. Jindal U.C. "Strength of Materials" Asian Books Pvt Ltd, New Delhi 2007
3. Egor.P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi 1997
4. Subramanian R. "Strength of Materials" Oxford University Press, Oxford Higher Education series, 2007
5. Hibbeler, R.C, Mechanics of materials", Pearson Education, Low Price Edition, 2007
6. Vazirani, N, ratwani, M. "Analysis of Structures" Khanna Publishers, New Delhi 2001

ET-524 (A): PRINCIPLES OF ENGINEERING MANAGEMENT AND ECONOMICS

Lecture	Tutorial	PRACTICAL	Credit	Marks
3	**1**	**--**	**4**	External: 70+Internal:30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1: BASIC CONCEPTS: Management: Thought and Functions, Micro-Economics for Engineers, Economic Environment and Policies, Human Behaviour at Work, Staff Training and Development.

UNIT 2: ORGANISATION: Organisation Structure and Compatibility, Power, Authority and Delegation, Organisation Dynamics – A Response to Growth and Decay

UNIT 3: MANAGERIAL CONTROL STRATEGIES: Management of Quality, Time Value of Money, Decision Making: Models, Techniques and Processes

UNIT 4: INTRODUCTION TO PROJECT MANAGEMENT: Projects: Concept and Phases, Project Management, Value Engineering, Eco-Friendliness of Projects.

References:

1. Industrial Management. L.C. Jhamb, Everest Publishing house.
2. Industrial Engineering and management-O.P. Khanna, Dhanapat Rai publications
3. Industrial Management –S.C. Jain, H.S.BAWA, Dhanapat Rai publications
4. Industrial Management –D.P. Bhivpathak, L.C. Jhamb, JM
5. Industrial Management – Inamdar, AR Bokil, Everest Publishing house.

BIEE-005 ELECTROMAGNETIC THEORY

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT 1

Electrostatic Field in Free Space: Coulomb's Law, Electric Force & concept of Electric Field, Electric potential, Gauss Theorem and application

UNIT 2

Conductor and Insulators in Electric field: Relation between Electrostatic potential and charges on conducting bodies, generalized form of Gauss's theorem, calculation of capacitance, Boundary conditions in Electrostatics

UNIT3

Electrostatic field problems: Direct solving of laplace Equations (Boundary and surface conditions, coordinate systems, separation of variables, in rectangular, cylindrical, spherical, coordinate system) Green's function, conformal transformation and complex variables, method of images, graphical method of solving electrostatic problems.

UNIT 4

Steady magnetic field: Biot savart law, Ampere's law, Stroke's theorem, magnetic flux density and vector magnetic potential, current carrying conductor in magnetic fields, torque on a loop, Energy stored in magnetic field, Maxwell's Equations, and boundary condition

UNIT 5

Electromagnetic waves: Wave propogation in dielectric & conducting media also in loss less nonconductors, Law of refraction & Snell's law of refraction, Reflection of Electromagnetic wave for normal incidence, perpendicular, polarization, parallel polarization, standing waves, power and pointing vectors.

UNIT 6

Transmission lines: Transmission line equations, transmission line parameters, sinusoidal steady state excition, mith's chart, impendence matching, impendence measurement, single and double stub matching transients in loss less lines,

RECOMMENDED BOOKS

1) Electromagnetic Engg. By William H.Hayt, Jr John A Buck, 6th Edition Mc Graw Hill
2) Electromagnetic Theory and applications by Ashutosh Pramanik PHI Ltd
3) Electromagnetic by Joseph A.Edminster. Tata Mc Graw Hill
4) Electromagnetic. by John d. Kraus, Tata Mc Graw Hill

BASL-006 LAB-V (Computer Programming Lab)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	1	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

List of PRACTICAL

1. Write a program to produce ASCII equivalent of given number
2. Write a program to find divisor or factorial of a given number.
3. Write a program to evaluate the following algebraic expressions after reading necessary values from the user
   - (ax+b)/(axb)
   - 2.5 log xcos 30+|x^2-y^2|+sqrt (2xy)
   - (x^5+10x^4+8x^3+4x+2
4. Write a program to find sum of a geometric series
5. Write a program to cipher a string
6. Write a program to check whether a given string follows English capitalization rules.
7. Write a program to find sum of the following series
   1+ ½ + 1/3 +_____+1/20
8. Write a program to search whether a given substring exist in an input string or not and then delete this string from input string.
9. Write a recursive program for tower of Hanoi problem
10. The fibonacci sequence of numbers is 1,1,2,3,5,8.. Based on the recurrence relation
    F(n)=F(n-1)+F(n-2)for n>2 Write a recursive program to print the first m Fibonacci number.
11. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices
    a) Addition of two matrices
    b) Subtraction of two matrices
    c) Finding upper and lower triangular matrices
    d) Trace of a matrix
    e) Transpose of a matrix
    f) Check of matrix symmetry
    g) Product of two matrices.
12. Write a program that takes two operands and one operator from the user perform the operation and then print the answer.
13. Write a program to print the following outputs:

1 1
2 2 2 2
3 3 3 3 3 3

14. Write functions to add, subtract, multiply and divide two complex numbers (x+iy) and (a+ib) Also write the main program.

15. Write a menu driven program for searching an sorting with following options:-
    h) Searching (1) Linear searching (2) Binary searching
    i) Sorting (1) Insertion sort (2) Selection sorting
16. Write a program to copy one file to other, use command line arguments.
17. Write a program to mask some bit of a number (using bit operations)
18. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.

BIMEL-002 Lab- VI (Strength of Materials Lab)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

List of Experiments in Strength of Materials (Any Eight)

1. To determine shear force (SF) and Bending moment (BM) diagram at various sections of a simply supported beam loaded with several point load on plain paper.
2. To determine yield stress, ultimate stress, young's modulus, percentage elongation of a mild steel rod by Universal testing machine.
3. Determination of bending test on timber.
4. Determination of bending test on floor tiles.
5. Determination of modulus of rigidity of a curve by torsion apparatus.
6. Determination of deflection and stiffness of a helical spring.
7. To determine hardness of a plate by Rock wells Brinell's hardness testing machine.
8. To determine impact resistance of a material by Izode impact testing machine.
9. To determine compression test on timber, bricks, mild steel and copper.
10. Determination of water absorption test on bricks.
11. Determination of water absorption test on floor tiles.
12. To determine the moisture content and specific gravity of timber.

BICE-007: MATHEMATICS –III

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Unit – I: Function of Complex variable

Analytic function, C-R equations, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic function, Taylor's and Laurent's series, singularities, Residue theorem, Evaluation of real integrals of the type and

Unit – II: Statistical Techniques - I

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non – linear and multiple regression analysis, Probability theory.

Unit – III: Statistical Techniques - II

Binomial, Poisson and Normal distributions, sampling theory (small and large), Tests of significations: Chisquare test, t-test, Analysis of variance (one way), Application to engineering, medicine, agriculture etc. Time series and forecasting (moving and semi-averages), Statistical quality control methods, Control charts, R, p, np, and c charts.

Unit – IV: Numerical Techniques – I

Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton- Raphson method, Rate of convergence of above methods.

Interpolation: Finite differences, difference tables, Newton's forward and backward interpolation , Lagrange'sand Newton's divided difference formula for unequal intervals.

Unit – V : Numerical Techniques –II

Solution of system of linear equations, Gauss- Seidal method, Crout method. Numerical differentiation, Numerical integration, Trapezoidal, Simpson's one third and three-eight rules, Solution of ordinary differential (first order, second order and simultaneous) equations by Euler's, Picard's and forth-order Runge- Kutta mehthods.

Reference Books:-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. Jain, Iyenger & Jain, Numerical Methods for Scientific and Engineering Computation, New AgeInternational, New Delhi, 2003.
3. J.N. Kapur, Mathematical Statistics, S. Chand & company Ltd.,2000
4. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House, 2002.
5. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
6. E. Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

8. Devi Prasad, An introduction to Numerical Analysis, Narosa Publication house, New Delhi 2006.
9. T. Veerajan & T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi, 2004.
10. S.P.Gupta, Statistical Methods, Sultan and Sons, New Delhi, 2004.
11. Devore, Probability and Statistics, Thomson(Cengage) Learning, 2007.
12. Walpole, Myers, Myers & Ye, Probability and Statistics for Engineers & Scientists, Pearson Education, 2003.

BIEE-007: ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

General Principles of Measurements-Standards- Absolute and Working Standards- Calibration of Meters- Qualities of Measurements- Characteristics- Errors in Measurement and its Analysis- Direct Deflecting Instruments - Moving Coil - Moving Iron, Dynamo Meter, Induction, Thermal, Electrostatic and Rectifier Type- Shunts and Multipliers- Various Types of Galvanometers.

UNIT II

Measurement of Current, Voltage and Resistance- Measurement of Insulation Resistance, Earth Resistance, Earth Tester- Measurement of Power and Energy - Dynamometer Type Wattmeter - Error and Compensation - Ampere Hour Meter - Single and Three Phase Energy Meters (Induction Type) - Calibration - Electronic Energy meter-Trivector Meter - Frequency Meters - Power Factor Meters - Energy / Harmonic Analyzer- Current Transformers and Potential Transformers.

UNIT III

Null Deflection Method - Measurement of Resistance, Current, Voltage and Power -Direct Current Potentiometer - Wheatstone Bridge - Kelvin Double Bridge - Carey Foster Slide Wire Bridge - Bridge Current Limitations - Localization of Cable Fault by Murray and Varley Loop Tests - A.C. Potentiometers - Various A.C. Bridges and Measurement of Inductance & Capacitance- Magnetic Measurements: Classification - Measurement of Flux and Permeability – Hibbert's Magnetic Standard - Flux Meter- Hall Effect- Gauss meter- Ballistic Galvanometer- Magnetic Measurements-B.H. Curve and Permeability Measurement - Hysteresis Measurement- Core Loss Measurement.

UNIT IV

Illumination- Laws of Illumination - Polar Curves - Photometry - Luminous Efficiency - Measurement of Illumination of Different Light Sources - Illumination of Surfaces - Levels of Illumination- Digital Measurements and Meters- Oscilloscopes - Basic Principle of Signal

Display - Triggered Sweep CRO - Trigger Pulse Circuit - Delay Line in Triggered Sweep - Synchronous Selector for Continuous Sweep CRO - Dual Beam CRO -Dual Trace Oscilloscope - Applications.

Reference books:

1: Golding E.W, Electrical Measurements & Measuring Instruments, Wheeler Pub, 1999.
2: Cooper W.D, Modern Electronics Instrumentation, Prentice Hall of India, 1996.
3: Stout M.B, Basic Electrical Measurements, Prentice Hall, 1986.
4: Oliver & Cage, Electronic Measurements & Instrumentation, McGraw Hill, 1979.

BIEE-008: ELECTRO-MECHANICAL ENERGY CONVERSION –I

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Unit – I

Principles of Electro-mechanical Energy Conversion - Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems(defining energy & Co-energy) , Singly Excited Systems; determination of mechanical force, mechanical energy, torque equation , Doubly excited Systems; Energy stored in magnetic field, electromagnetic torque , Generated emf in machines; torque in machines with cylindrical air gap .

Unit – II

D.C. Machines:- Construction of DC Machines, Armature winding, Emf and torque equation , Armature Reaction ,Commutation , Interpoles and Compensating Windings, Performance Characteristics of D.C. generators.

Unit –III

D.C. Machines (Contd.):- Performance Characteristics of D.C. motors, Starting of D.C. motors; 3 point and 4 point starters, Speed control of D.C. motors: Field Control, armature control and Voltage Control (Ward Lenonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburn's Test).

Unit –IV

Single Phase Transformer: Phasor diagram, efficiency and voltage regulation, all day efficiency.

Testing of Transformers: O.C. and S.C. tests, Sumpner; s test, polarity test.

Auto Transformer: Single phase and three phase auto transformers, volt-amp, relation, efficiency, Merits & demerits and applications.

Unit –V

Three Phase Transformers: Construction, three phase transformer phasor groups and their connections, open delta connection, three phase to 2 phase, 6 phase or 12 phase connections, and their applications, parallel operation and load sharing of single phase and three phase transformers, excitation phenomenon and harmonics in transformers, three winding transformers.

Reference Books:

1. I.J. Nagrath & D.P.Kothari," Electrical Machines", Tata McGraw Hill
2. Husain Ashfaq ," Electrical Machines", Dhanpat Rai & Sons
3. A.E. Fitggerald, C.Kingsley Jr and Umans,"Electric Machinery" 6th Edition McGraw Hill, International Student Edition.

4. B.R. Gupta & Vandana Singhal, "Fundamentals of Electrical Machines, New Age International.
5. Irving L.Kosow, "Electric Machine and Tranformers", Prentice Hall of India.
6. M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.
7. Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" Oxford University Press, 2001.

BIEE-009: APPLIED ELECTROMAGNETICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Co-ordinate transformation - vector fields - Divergence theorem – Stoke's Theorem - static electric field - electric flux – Gauss's law - electric scalar potential - electric dipole moment – electric field due to line charge, point charge and surface charge- method of images.

UNIT II

Electric field polarization - condition at boundary between dielectrics- capacitance of isolated sphere - capacitance between co-axial cylinder - capacitance between parallel wires - energy density in static field - solution of Laplace and Poisson's equation in electrostatics.

UNIT III

Magnetic field - steady magnetic field - conduction current - conduction current density - Biot-Savart's law and Ampere's law - vector potential concept of inductance - inductance of solenoid - toroid concept of resistance - magnetic moment - torque on a loop - transmission lines - electromagnetic induction – Faraday's law- Continuity equation - displacement current – Maxwell's equation.

UNIT IV

Plane waves - Poynting vector and Poynting's theorem - solutions for free space condition - wave equation for a conducting medium - wave polarization - linear - elliptic and circular polarization-wave equation on transmission line - co-axial and two wire transmission lines-characteristic impedance - reflection coefficient - standing wave ratio.

Reference books:

1. Kraus J.D, Electromagnetics, McGraw Hill 3, 1999.
2. Sadiku M.N.O, Elements of Electromagnetics, Addison Wesley 3, 2002.

3. Cheng D.K, Field and Wave Electromagnetics, Addison Wesley3, 2002.
4. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, Prentice Hall 5, 2002.
5. Hayt W.H, Engineering Electromagnetics, McGraw Hill 6, 2002.
6. Nasar.S.A, 2000 Solved Problems in Electromagnetics , McGraw Hill, 1992.

BIEE-010: MICROCONTROLLERS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I:

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, A Microprocessors survey. RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture.

The 8051 Architecture: Introduction, 8051 Microcontroller Hardware, Input / Output Pins, Ports and Circuits External Memory, Counter and Timers, Serial Data Input / Output, Interrupts.

UNIT II:

Addressing Modes and Operations: Introduction, Addressing modes, External data Moves, Code Memory, Read Only Data Moves / Indexed Addressing mode, PUSH and POP Opcodes, Data exchanges, Example Programs; Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Example Programs.

UNIT III:

Jump and Call Instructions: The JUMP and CALL Program range, Jumps, calls and Subroutines, Interrupts and Returns, More Detail on Interrupts, Example Problems

UNIT IV:

8051 programming in C: Data types and time delays in 8051C, I/O programming, logic operations, data conversion programs, accessing code ROM space, data serialization.

UNIT V:

Timer / Counter Programming in 8051: Programming 8051 Timers, Counter Programming, programming timers 0 and 1 in 8051 C

UNIT VI:

8051 Serial Communication: Basics of Serial Communication, 8051 connections to RS-232, 8051 Serial communication Programming, Programming the second serial port, Serial port programming in C.

UNIT VII:

Interrupts Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051/52, Interrupt programming in C

UNIT VIII:

8051 Interfacing and Applications: Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing, DC motor interfacing and PWM

TEXT BOOKS:

1. "The 8051 Microcontroller Architecture, Programming & Applications", 2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005
2. "The 8051 Microcontroller and Embedded Systems – using assembly and C "-, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006

REFERENCE BOOKS:

1. "Programming and Customizing the 8051 Microcontroller" Predko ;–, TMH
2. Microcontrollers: Architecture, Programming, Interfacing and System Design",Raj Kamal, "Pearson Education, 2005
3. "Microcontrollers- Theory and Applications", Ajay V.Deshmukh; TMH,2005
4. "Microcontroller and its applications", Dr.Ramani Kalpathi and Ganesh Raja; Sanguine Technical publishers,Bangalore-2005

BIEEL-003: LAB-VII (ELECTRICAL MEASUREMENTS LABORATORY)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

LIST OF EXPERIMENTS:

1. Determination of B-H curve, μ_r - H curve and μ_r -B curve of an iron ring specimen.
2. Calibration of magnetic flux meter using standard solenoid, search coil and Hibbert's magnetic standard.
3. a) Measurement of low/medium resistance using Kelvin's double bridge and Wheat stone's bridge.
   b) Measurement of Capacitance and Inductance using AC bridges.
4. Calibration of dynamometer type wattmeter using slide wire potentiometer.
5. Extension of range of ammeter/voltmeter using shunt/series resistance and calibration of the extended meter using standard ammeter/voltmeter.
6. Extension of range of a dynamometer type wattmeter using CT/PT and calibration of the extended meter using a standard wattmeter.
7. Calibration of single-phase energy meter by direct loading and phantom loading at various power factors.
8. Calibration of 3-phase energy meter using standard wattmeter.
9. Determination of hysteresis loop of an iron ring specimen using 6-point method and CRO.
10. Measurement of branch and node voltages of a given R-L-C circuit using AC potentiometer.
11. Measurement of candlepower of given light sources. Determine the illumination levels at different working planes and verify laws of illumination.
12. a) Determination of MSCP of an Incandescent lamp/CFL.
    b) Determination of the polar curve of candle power distribution and hence find MHCP/MSCP of light sources.

BIEEL-004: LAB-VIII (ELECTRO-MECHANICAL ENERGY CONVERSION- I LAB)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Any eight experiments are to be performed from the following list :

1. To obtain magnetization characteristics of a d.c. shunt generator
2. To obtain load characteristics of a d.c. shunt generator and compound generator
   (a)Cumulatively compounded (b) Differentially compounded

3. To obtain efficiency of a dc shunt machine using Swinburn's test
4. To perform Hopkinson's test and determine losses and efficiency of DC machine
5. To obtain speed-torque characteristics of a dc shunt motor
6. To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control

7. To obtain speed control of dc separately excited motor using Conventional Ward-Leonard/Static Ward –Leonard method.
8. To study polarity and ratio test of single phase and 3-phase transformers
9. To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformerusing C.C. and S.C. tests.
10. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test.
11. To obtain 3-phase to 2-phase conversion by Scott connection.
12. To determine excitation phenomenon (B.H. loop) of single phase transformer using C.R.O

BIEEL-005: LAB-IX (MICROCONTROLLERS LAB)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

II. INTERFACING

Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.

8. Simple Calculator using 6 digit seven segment display and Hex Keyboard interface to 8051.
9. Alphanumeric LCD panel and Hex keypad input interface to 8051.
10. External ADC and Temperature control interface to 8051.
11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
12. Stepper and DC motor control interface to 8051.
13.. Elevator interface to 8051.

BIEE-011: ELECTRICAL MACHINES –II

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Synchronous Generator: Constructional Features of Salient Pole and Non-Salient Pole Machines, Arrangement of Field Winding in the two types of Machines.
Cylindrical Rotor Theory: Phasor Diagram, Synchronous Reactance from O.C. and S.C. Characteristics, Load Characteristics, Z.P.F. Characteristics, Voltage Regulation by different methods, Power Angle Characteristics. Salient-Pole Theory: Blondel"s Two-Reaction Concept, Direct Axis and Quadrature Axis Synchronous Reactance, Power Angle Characteristics, Slip Test. Parallel Operation.

Synchronous Motor: Constructional features, Phasor Diagram, Torque and Power Relations in Non-Salient Pole and Salient Pole Motors, V-Curves, Various Types of Excitation, Synchronous Condenser, Methods of Starting, Applications.

Three Phase Induction Motor: Constructional Features of Slip Ring and Squirrel Cage Type Motors, Principle of Operation, Flux and MMF Wave, No-Load Speed and Slip, Rotor Quantities Referred to Stator, Relationship Between Input Voltage and Current, Equivalent Circuit, Analysis of Equivalent Circuit, Torque Speed Characteristics, Starting, Maximum and Full Load Torque, Condition for Maximum Torque, Regions of Stable and Unstable Operations, Effect of rotor resistance and supply frequency on Speed Torque Characteristics, Losses, Efficiency, Performance Characteristics, The Circle Diagram, Starting of Slip Ring and Squirrel Cage Motors, High Starting Torque Motors. Speed Control: Various methods.

Single phase induction motor: ; Constructional features, various types, Rotating magnetic field theory, Equivalent circuit, Determination of constants, methods of starting, Applications.

Single Phase Series Motor: Construction, Principle of Operation, Phasor Diagram, Operation with AC and DC supplies, the universal Motor, Performance Characteristics, Effect of Compensation, Repulsion motor, Applications.

Stepper Motor: Construction and Principle of Operation of Variable Reluctance Type and Permanent Magnet Type, Performance and Applications,

Brushless D. C. Motors: constructional features, principle of operation, applications.
Switched-Reluctance Motor: Constructional features, principle of operation and applications.

Reference Books

1. A. S. Langsdorf, Theory of A. C. Machines, TMH, 2001.
2. I. L. Kosow, Electric Machinery & Transformers, PHI, 2001.
3. A.E. Fitzagerald, C.M. Kingsley (Jr) and S. D. Umans, Electric Machinery, Tata McGraw Hill, 2003.
4. C. I. Hubert, Electric Machines, Pearson Education, 2003.

BIEE-012: ELECTRO-MECHANICAL ENERGY CONVERSION – II

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT-I

Synchronous Machine I

Constructional features, Armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage Regulation using Synchronous Impedance Method, MMF Method, Potier's Triangle Method, Parallel Operation of synchronous generators, operation on infinite bus, synchronizing power and torque co-efficient

UNIT-II

Synchronous Machine II:

Two Reaction Theory, Power flow equations of cylindrical and salient pole machines, operating characteristics

Synchronous Motor:

Starting methods, Effect of varying field current at different loads, V- Curves, Hunting & damping, synchronous condenser

UNIT-III:

Three phase Induction Machine – I

Constructional features, Rotating magnetic field, Principle of operation Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Induction generator & its applications.

UNIT-IV

Three phase Induction Machine- II

Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed Control (with and without emf injection in rotor circuit.)

UNIT-V

Single phase Induction Motor:

Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, repulsion motor

AC Commutator Motors:

Universal motor, Single phase a.c. series compensated motor, stepper motors

Reference Books:

1. D.P. Kothari & I.J.Nagrath, "Electric Machines", Tata Mc Graw Hill

2. Ashfaq Hussain"Electric Machines" Dhanpat Rai & Company
3. Fitzerald,A.E.,Kingsley and S.D.Umans"Electric Machinery", MC Graw Hill.
4. P.S.Bimbhra, "Electrical Machinery", Khanna Publisher
5. P.S. Bimbhra, " Generalized Theory of Electrical Machines", Khanna Publishers
6. M.G.Say, "Alternating Current Machines",Pitman & Sons

BIEE-013: ELECTRICAL & ELECTRONICS ENGINEERING MATERIALS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT – I

1 Crystal Structure of Materials:

A. Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth

B. Energy bands in solids, classification of materials using energy band.

UNIT – II

2 Conductivity of Metals:

Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials, Properties and applications of electrical conducting and insulating materials, mechanical properties of metals

UNIT – III

Mechanism of Conduction in semiconductor materials:

Types of semiconductors, current carriers in semiconductors, Half effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semi conducting materials.

UNIT – IV

Magnetic Properties of Material:

Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.

Reference Books :

1 A.J. Dekker,"Electrical Engineering Materials" Prentice Hall of India
2 R.K. Rajput," Electrical Engg. Materials," Laxmi Publications.
3 C.S. Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials, S.Chand & Co.
4 Solymar, "Electrical Properties of Materials" Oxford University Press.

5. Ian P. Hones," Material Science for Electrical and Electronic Engineering," Oxford University Press.
8 G.P. Chhalotra & B.K. Bhat, "Electrical Engineering Materials" Khanna Publishers.
9 T. K. Basak, "Electrical Engineering Materials" New age International.

BIEE-014: NETWORK THEORY

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Unit – I:
Graph Theory : Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Nodal methods of analysis.
Unit – II:
Network Theorems (Applications to ac networks): Super-position theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Reciprocity theorem. Millman's theorem, compensation theorem, Tellegen's theorem.
Unit – III :
Network Functions :
Concept of Complex frequency , Transform Impedances Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot.
[
Unit – IV :
Two Port Networks:
Characterization of LTI two port networks ZY, ABCD and h parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T & Π Representation.
Unit – V :
(a) Network Synthesis :
Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.
(b) Filters:
Image parameters and characteristics impedance, passive and active filter fundamentals, low pass, highpass, (constant K type) filters, and introduction to active filters.

Reference Books

1 M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India

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

BIEE-015: MICROPROCESSOR & ITS APPLICATIONS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Introduction To Microprocessor
History and Evolution, types of microprocessors, 8085 Microprocessor, Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions.

Assembly Language Programming and Timing Diagram
Assembly language programming in 8085, Macros, Labels and Directives, Microprocessor timings,
Micro instructions, Instruction cycle, Machine cycles, T states, State transition diagrams, Timing diagram for different machine cycles.

Serial I/O, Interrupts and Comparison of Contemporary Microprocessors
Serial I/O using SID, SOD. Interrupts in 8085, RST instructions, Issues in implementing interrupts,
Multiple interrupts and priorities, Daisy chaining, Interrupt handling in 8085, Enabling, disabling and
masking of interrupts. Brief comparison of contemporary 8-bit microprocessors like Z-80, M68000
with 8085.

Data Transfer techniques
Data transfer techniques, Programmed data transfer, Parallel data transfer using 8155. Programmable
parallel ports and handshake input/output, Asynchronous and Synchronous data transfer using 8251A.
Programmable interrupt controller 8259A. DMA transfer, cycle stealing and burst mode of DMA,
8255, 8257 DMA controller.

Microprocessor Interfacing Techniques
Interfacing memory and I/O devices, Addressing memory, interfacing static RAMs, Interfacing and
refreshing dynamic RAMs, Interfacing a keyboard, Interfacing LED and seven segment displays, Interfacing a printer, Interfacing A/D converters, D/A converters.

Architecture of typical 16 bit microprocessors (Intel 8086)

Memory address space and data organization - Segment registers and memory segmentation - Generating a memory address - I/O address space - Addressing modes - Comparison of 8086 and 8088 - Basic 8086/8088 configuration - Minimum mode - Maximum mode - System timing.
Introduction to 80186/188, 286, 386 & 486 with Block diagram, features & application.

Books Recommended: -

1. R.S. GAONKAR, Microprocessor Architecture, Programming and applications with the 8085/8080A, Wiley Eastern
Ltd.
2. A.H. MUHOPADHYAY, Microprocessor Based Laboratory Experiments and Projects, Wheeler Publishing, 1997.
3. YU-Cheng Liu & Glenn A Gibson, Microprocessor System, Architecture Programming & Design.

REFERENCE BOOKS

1. D.V.HALL, Microprocessors and Digital Systems, McGraw Hill
2. INTEL 8086/88, 80186, 286, 386, 486, Pentium Pro & Pentium IV- By Berry.B.Bray.

BIEEL-006: LAB-X (ELECTRICAL MACHINES LAB –II)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total..

1. Determination of regulation of alternator by Synchronous Impedance method.

2. Determination of regulation of alternator by zero power factor method.

3. „V" and „Λ" curves of Synchronous Motor

4. Measurement of Xd & Xq of synchronous machine.

5. Parallel Operation of 3 Phase Alternator with infinite Bus Bar.

6. No load and Blocked rotor test of single phase induction motor.

7. No load and Blocked rotor test of three phase induction motor.

8. Separation of different losses in squirrel-cage Induction Motor.

9. Separation of losses in slip ring Induction motor by Richter"s method.

10. Three phase transformer connection.

10. Scott connection of transformer.

11. Determination of sequence impedance of alternator.

BIEEL-007: LAB-XI (ELECTRO-MECHANICAL ENERGY CONVERSION – II LABORATORY)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Any 8 experiments are to be performed from the following

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw:
   (i) Torque -speed characteristics
   (ii) Power factor-line current characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by Keeping V/f ratio constant
5. To study speed control of three phase induction motor by varying supply voltage.
6. To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii) MMF method.
7. To determine V-curves and inverted V-curves of a three phase synchronous motor.
8. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and draw the power-angle curve.
9. To study synchronization of an alternator with the infinite bus by using:
(i) dark lamp method (ii) two bright and one dark lamp method

Software based experiments (Develop Computer Program in 'C' language or use MATLAB
or other commercial software)

10. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.
11. To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
12. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.

13. Draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
14. To determine steady state performance of a three phase induction motor using equivalent circuit.

BIEEL-008: LAB-XII (NETWORK LABORATORY)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

ANY eight experiments are to be performed from the following list.

1. Verification of principle of superposition with dc and ac sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits
3. Verification of Tellegin's theorem for two networks of the same topology
4. Determination of transient response of current in RL and RC circuits with step voltage input
5. Determination of transient response of current in RLC circuit with step voltage input for underdamp, critically damp and overdamp cases
6. Determination of frequency response of current in RLC circuit with sinusoidal ac input
7. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values
9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests Write Demo for the following (in Ms-Power point)
10. Verification of parameter properties in inter-connected two port networks : series, parallel and cascade also study loading effect in cascade.
11. Determination of frequency response of a Twin – T notch filter.
12. To determine attenuation characteristics of a low pass / high pass active filters.

BIEE-016: ELECTROMECHANICAL ENERGY CONVERSION-III

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Basis for development of generalized approach for analysis of electrical machines, Kron's primitive machines, concepts of rotational & transformer voltages, concept of pseudo stationary coils, voltage and flux linkages, equation of electrical machine based on coupled circuits approach, expressions for self and mutual inductance of various windings with respect to rotor position, Park's & inverse Park's transformations and their physical significance, expressions for flux linkages in terms of park's variables, transformed impedance matrix.

UNIT II

Formation and development of steady state equations based on a generalized approach for DC machine, Steady state behavior of DC machine, interconnection of machines, generalized model for different types of DC machines, transfer function of DC machines.

UNIT III

Basic synchronous machine parameters and generalized model of 3-phase synchronous machine (with & without damping machine), balanced steady state analysis and power angle characteristics, transient analysis, sudden reactive loading & unloading, sudden 3-phase short circuit of synchronous machine, reactances & time constants from Oscillogram.

UNIT IV

Development of generalized model for 3-phase induction machine, performance equation & steady state analysis, analysis of equivalent circuit, transient analysis by using generalized theory, effect of voltage & frequency variations on the induction motor performance, operation of I.M. on unbalanced supply voltage.

UNIT V

Constructional features, working principle and analysis of Single Phase Series motor,

Stepper motor, Linear Induction Motor, Hysteresis motor, Universal Motor and Reluctance motor. AC & DC servo motors, brushless DC motor, Scherage motor, repulsion motor.

Reference Books:

1. Generalised Theory of Electrical Machines -P.S.Bhimbra
2. Electrical Machines - P.S.Bhimbra
3. Electrical Machines - P.S.Nagrath and D.P.Kothari
4. Electrical Machines - Fitzerald Kingsley

BIEE-017: DIGITAL ELECTRONICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Introduction to Boolean algebra and Switching Function, Boolean minimization. Combinational Logic Design using MSI circuits : Full Adder / Subtractor, BCD Adder, LAC Adder, Decoder, MUX/DEMUX three structure, Combinational logic design using ROM array, Applications of MSI designs. ; Integrated Circuits: Difference between combinational and sequential circuits, Flip Flops, Counters, Shift Registers and PLA. ; Analysis and Synthesis of Sequential Circuits: Basic models of sequential M/C, Analysis of Asynchronous and Synchronous circuits, Synthesis of completely and incompletely specified synchronous sequential M/Cs.; Introduction to Microprocessor : Overview of architecture of Intel 8085 Microprocessor (Register, Stack, Interrupt) Instruction set and programming. ; Introduction to 16 Bit Microprocessor : Architecture of 8086 CPU architecture, Internal operations, Machine Language instructions, Addressing mode, Instruction Format, Instruction executions, Addressing mode, Instruction Format, Instruction execution timing, comparison of 8088 with 8086. Assembly language programming and Instructions: Assembler instruction format, Data Transfer, Arithmetic, Branch, Flag manipulation, Logical, Shift and Rotate. String Manipulation Stack Manipulation, all and return instructions, REP Prefix, segment override prefix, and simple assembler directives such as real, variable, DB, DW, DD, EQU, END, Assume, pointer (byte, word, double word, Near, Short, and Far).

Reference Books

1. B. N Jain and R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, 2006.

2. B. B. Bray, The Intel Microprocessors- 8086/8088, 80186, 80286, 80386, and 80486-Architecture, Programming and Interfacing, Prentice Hall, 2000.

3. D.V. Hall, Microprocessor and Interfacing programming & Hardware, TMH, 2001.

4. K. Ray and K. M. Bhurchandi, Advanced Microprocessors & Peripherals: Architecture, Programming & Interfacing, TMH, 2008.

5. C. H. Roth (Jr.), Fundamentals of Logic design, Cengage Engineering, 2003

BIEE-018: HIGH VOLTAGE ENGINEERING

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Generation of High voltages and currents, AC voltages: cascade transformers-series resonance circuits DC voltages: voltage doubler-cascade circuits-electrostatic machines Impulse voltages: single stage and multistage circuits-wave shaping-tripping and control of impulse generators Generation of switching surge voltage and impulse currents

UNIT II

Measurement of high voltages and currents-DC,AC and impulse voltages and currents-DSO-electrostatic and peak voltmeters-sphere gaps-factors affecting measurements-potential dividers(capacitive and resistive)-series impedance ammeters-rogowski coils-hall effect generators

UNIT III

High voltage testing of materials and apparatus-preventive and diagnostic tests-dielectric loss measurements-schering bridge-inductively coupled ratio arm bridge-partial discharge and radio interference measurement-testing of circuit breakers and surge diverters

UNIT IV

Introduction to Insulation materials. Breakdown in gas and gas mixtures-breakdown in uniform and non uniform fields-Paschens law-Townsends criterion-streamer mechanism-corona discharge-breakdown in electro negative gases- Breakdown in liquid dielectrics-suspended particle mechanism-Breakdown in solid dielectrics-intrinsic, streamer, thermal breakdown.

Reference Books:

1 M. S. Naidu, V. Kamaraju, "High Voltage Engineering", McGraw-Hill, 3 ed.,1995.

2 M. Khalifa, "High Voltage Engineering: Theory and Practice", Dekker, 1990.
3 H. M. Ryan, "High Voltage Engineering and Testing", IEE 2001.
4 Kuffel and Zaengal , “High Voltage Engineering Fundamentals”, Newness, 2 ed.2002
5 Kuffel and Abdullah.M, “High Voltage Engineering”, Pergamon press,1978

BIEE-019: ELECTRICAL INSTRUMENTATION

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Unit-I:

Transducer – I:

Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, Potentiometers, Strain gauges, Resistance thermometer, Thermistors, Thermocouples, LVDT,RVDT

Unit-II

Transducer – II :

Capacitive, Piezoelectric Hall effect and opto electronic transducers.
Measurement of Motion, Force pressure, temperature, flow and liquid level.

Unit-III:

Telemetry :

General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data

Acquisition System:

Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system.

Unit-IV:

Display Devices and Recorders:

Display devices, storage oscilloscope, spectrum analyzer, strip chart & x-y recorders, magnetic tape & digital tape recorders.

Recent Developments:

Computer aided measurements, fibre optic transducers, microsessors, smart sensors, smart transmitters.

Unit-V:

Process Control :

Principle, elements of process control system, process characteristics, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers.

Reference Books:

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

BIEE-020: ELECTRICAL MACHINES AND ELECTRONICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

POLYPHASE SYSTEMS

Introduction to polyphase system, phase sequence, star & delta connections, phasor diagrams, analysis of 3-phase balanced & unbalanced circuits. Measurement of 3-phase power for balanced & unbalanced loads, measurement of reactive volt amperes.

UNIT II

TRANSFORMERS

Single phase and 3-phase transformers, Routine tests of transformer, equivalent circuit and vector diagram, losses, efficiency and regulation, Welding transformer.

UNIT III

INDUCTION MOTORS

Production of rotating magnetic field, construction and principle of operation of a 3-phase machines. Slip-torque characteristics, 3-phase induction motor starters, Single phases induction motor, principle of operation and methods of starting, Testing of single phase and three phase Induction Motors.

UNIT IV

SELECTION AND APPLICATIONS OF INDUSTRIAL MOTORS

Introduction, factors affecting selection of motors, Types of loads, steady state and Dynamic characteristics of Electric drives, size of motor, Load equalization, application of motors for Industrial use.

UNIT V

INDUSTRIAL ELECTRONICS

Thyristors and their characteristics, turn-on and turn-off methods, basics of chopper rectifiers and inverters. Control of a.c. and d.c. motors using power electronic devices.

Reference Books:

1. Basic Electrical Engineering – V. N. Mittle & A. Mittal
2. Power Electronics - M.D.Singh
3. Electrical Machines - J.B.Gupta
4. Principle of Elect. Machine and Power Electronics - P.C.Sen
5. Generation, Distribution & Utilization of Electric Energy - C.L. Wadhwa

BIEEL-009: LAB-XIII (DIGITAL ELECTRONICS LAB)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

1.Study of basic logic gate and universal logic gate ,realization of logic circuits using universal logic gate

2. Study of various Flip- Flops.

3. To construct and verify the operation of single digit and multi digit half adder, Full adder / subtracted using logic gates and IC 7483.

4. To study the characteristics and operation of a programmable Shift Register using IC 7495.

5. Study of MUX & DEMUX circuits.

6. Verification of UP/ DOWN count using IC 74193.

7. Minimization of Boolean function using „K" map and Realization of circuit using NAND & NOR gates.

8. Study of Digital to Analog converter by weighted resistance method.

9. Design and verification of A/D converter.

10. Study of Seven Segment Display Technique using IC 7447/ 7446.

11. Study of Ring and Decade Johnson Ring counters using ICs and Flip- Flops.

12. Comparison of Sequential and Combinational Logic Circuits.

BIEEL-010: LAB-XIV (ELECTRICAL INSTRUMENTATION LAB)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 30+Internal:70 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Any ten experiments should be performed from the following

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge based displacement transducer.
3. Measurement of displacement using magnetic pickup.
4. Measurement of load using strain gauge based load cell.
5. Measurement of water level using strain gauge based water level transducer
6. Measurement of flow rate by anemometer
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple
9. Study of P,PI and PID controllers
10. Study of storage oscilloscope and determination of transient response of RLC circuit.
11. Determination of characteristics of a solid state sensor/fibre-optic sensor
12. Design and test a signal conditioning circuit for any transducer
13. Study of data acquisition system using "**lab view**" software and test all signal points
14. Measurement of sine, triangular, square wave signal of function generator and verify its frequency at 100 Hz tap point using "**lab view**" software.
15. Measurement of voltage and current signal of programmable power supply using **Lab view** GPIB interface.

BIEE-021: CONTROL SYSTEM

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Introduction to Automatic Control: Concept of control system, Definition, Open Loop/Closed-loop, Basic elements of a servo mechanism, Types of servomechanism, Development of Automatic Control.

Mathematical Model: Mathematical representation of physical system, Electrical mechanical systems, liquid level system, Transfer function and impulse response of linear systems, Block diagram, signal flow graphs, Application of the signal flow graphs for gain formula to block diagrams. Mathematical modeling of dynamical systems.

General Feedback Theory: Feedback, effect of feedback, Mathematical definition of feedback.

Control System Components: Potentiometer, Synchros, A.C. Servo motors D.C. and A.C. tacho generator, Example of closed loop systems using D.C. & A.C. Servomotors, Synchros, Tacho generators; Hydraulic Systems & Pneumatic Systems; Pump controlled and valve controlled Hydraulic motor & Actuators, Hydraulic valve, Hydraulic controllers and Pneumatic controllers.

Time Response of feedback control systems: Typical test signal for the transient analysis, time domain performance characteristics of feedback control systems, transient response, transient response of 2nd order systems, transient response of a positional servomechanism, effects of derivative and integral controls on the transient performance, PI, PD, PID controllers, Tachometer feedback, Steady state response steady state error, The generalized error analysis.

Stability linear control system: Routh-Hurwitz criterion. Frequency response method polar plots, Bodes plot, Magnitude versus phase shift plot frequency response of feedback control system, Frequency domain specifications, MP and WP for a second order system.

The Nyquist criterion and stability : ; Introduction, The Principle of argument the Nyquist path, Nyquist criterion and the GH Plot, The application of the Nyquist criterion, The effects of additional poles and zeros of G(s) H(s) on the shape of the Nyquist locus, Relative stability, gain margin, Phase margin, conditionally stable systems.

The Root Locus Technique: Introduction to Root Locus, construction of the root loci, some other properties of the root locus, root locus of conditional stable systems.

Compensator Design: Lag/Lead/Lag-Lead Compensator Design using Root Locus & Bode Plot Methods.

State variable analysis : ; Introduction, Concept of state, state variable and state model, State equations of continuous data control system, Derivation of state Model from transfer functions and Vice versa. Diagonalisation, Solution of state equation.

Reference Books

1. K. Ogata, Modern Control Engineering, Pearson, 2003.
2. I.J. Nagrath, and M. Gopal, Control System Engineering, New Age, 2002
3. M. Gopal, Control Systems: Principles and Design, TMH, 2008.
4. B.C. Kuo, Automatic Control System, Prentice Hall, Digitized Dec 5, 2007

BIEE-022: POWER SYSTEM

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Unit-I

Representation of Power System Components:

Synchronous machines, Transformers, Transmission lines, one line diagram, Impedance and reactance diagram, per unit System

Symmetrical components:

Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

Symmetrical fault analysis:

Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions

Unit-II

Unsymmetrical faults:

Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance.Formation of Zbus using singular transformation and algorithm, computer method for short circuit calculations

Unit-III

Load Flows:

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

Unit-IV

Power System Stability:

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

Unit-V

Traveling Waves:

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

Reference Books

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

BIEE-023: SWITCHGEAR AND PROTECTION

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Circuit breakers - principles of operation –RRRV- Current chopping. Constructional features and Selection of LT breakers (MCB/MCCB/ELCB) and HT Breakers (ABCB - OCB – SF_6CB– VCB); Circuit breaker ratings- Testing of circuit breakers.

UNIT II

Overvoltages – Surges and travelling waves – Wave propagation on transmission lines - reflection and attenuation- Lightning strokes- protection against lightning - earth wires- lightning diverters - surge absorbers - arcing ground - neutral earthing - basic concepts of insulation levels and their selection - BIL – Co-ordination of insulation.

UNIT III

Protective relays - protective zones - requirement of protective relaying- definitions-Codes-Standards - Types – Over current Relays - Earth fault relays- Directional relays- Differential relays- Distance relays- Under voltage/ Frequency relays. Static, digital and numerical relays-PC based relays-Construction-Characteristic Functions-Converter Elements-Comparators-Relay Schematics, Analysis.

UNIT IV

Protection Scheme for Generators-Power Station & DG sets, Power & Distribution Transformers, Transmission lines and Busbars, Motors.

NEC and importance of relevant IS/IEC specifications related to switchgear and protection.

References

1. Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons. NewDelhi, 1996
2. Sunil S Rao, "Switch Gear Protections", Khanna Publications, Delhi 1999
3. Allen Greenwood, "Electrical Transients in Power Systems", 1991.
4. Van. C. Warrington A.R., "Protective Relays" Vol. 1 & 2, Chapman & Hall, 1998.
5. T S Madhav Rao, "Power system protection static relays with microprocessor Applications", Tata McGraw hill Publication, 1998.
6. Badri Ram, D N Vishwakarma, "Power System Protection and Switchgear', Tata Mc Graw Hill, 2005.
7. Anderson P M, "Power System Protection", IEEE publication, 1999.
8. Walter -Marcel Dekker, "Protective relaying theory and applications", 2ed, Elmore, 2004.

BIEEL-011: LAB-XV (CONTROL SYSTEM LAB)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 15+Internal:35 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

1. Study of a DC motor driven closed loop position control system

2. Study of a Position Control System using Synchro.

3. Obtain speed-torque characteristics of a two-phase servomotor

4. Determine the transfer function of a system (network) using a transfer function analyzer

5. Position and Speed Control of a DC motor using PD and PID Controller via Ziegler Nicholos tuning method

6. Identification of a DC Motor transfer function

7. To study the discrete-time version of the PID controller, and to implement classical tuning rules for the digital control system.

8. PID Control with Derivative Filtering and Integral Antiwindup for a DC Servo

9. Controlling a process using dSPACE / Simulink and LABVIEW

9. To study and validate the controller type for a temperature control system.

10. To study on the interface of PLC with PC for data acquisition applications.

11. Experimentation of Control loops for Inverted Pendulum.

BIEEL-012: LAB-XVI (POWER SYSTEM LAB)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 15+Internal:35 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Any 10 experiments should be performed out of which 3 should be simulation based.

(A) Hardware Based:

1. To determine direct axis reactance (xd) and quadrature axis reactance (xq) of a salient Pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (xd) and sub transient quadrature axis reactance (xq) of an alternator
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays
8. To determine location of fault in a cable using cable fault locator
9. To study ferranty effect and voltage distribution in H.V. long transmission line using transmission line model.
10. To study operation of oil testing set.

(B) Simulation Based Experiments (using MATLAB or any other software)

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

BIEE-024: POWER ELECTRONICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Power Semiconductor Devices: Control characteristics of Power Semiconductor Devices, Types of Power Electronic Circuits.

Power Semiconductor Diodes: Types, Characteristics, Reverse Recovery Characteristics, Forward and Reverse Recovery Time, Series and Parallel Connection.

Thyristors: Characteristics, 2-Transistor Model, Turn on and Turn off, dv / dt and di / dt protection, Thyristor firing circuits, UJT, Gate Turn-off Thyristors (GTO), Triac, FET controlled Thyristor, MOS controlled Thyristors. Series and Parallel operation of Thyristors.

Line Frequency Phase Controlled Rectifiers and Inverters: Principle of Phase Control, Gate Trigger Controller Circuit. Single Phase Converter, Ideal Circuit with no source inductance and constant output d. c. current. Semi Converters and Full converter, Dual converter. Wave form and performance calculation, Effect of finite source inductance, Inverter Mode Operation.

Three Phase Converter : Ideal Circuit without source inductance with constant output d. c. current, Three Phase Full Converters, Wave form Performance, Input Line Currents, Effect of Source Inductance and Commutation, Inverter mode of operation, A.C. Voltage Waveform.
A.C. Voltage Controller: On-off control, Phase Control, R-Load, R-L Load, Cycloconverters Principles.
Power Transistors: BJT Switching Characteristics and Switching limits base drive control Power MOSFET, Switching characteristics and gate drive, IGBT and STT, Isolation of gate base drive.
DC-DC Switch Mode Converters (Choppers) : Principles of step-down chopper, step down chopper with R-L load, Principle of step-up operation, control of DC-Dc converter by PWM, Switching mode regulator, Step down (Back) Converter, Step-up (Boost) converter in Continuous Conduction mode.

Thyristor Commutation Technique: Self Commutation, Impulse Commutation, Complementary Commutation. The Impulse Commutated Chopper.

Pulse Width Modulated Inverters : Single phase half bridge and full bridge inverter, 3-phase inverter-180 degree and 120 degree conduction mode, Pulse Width Modulated Switching scheme for voltage control, SPWM and modified SPWM of 1-phase inverters, PWM with unipolar and Bipolar Voltage Switching, PWM in 3-phase VSI, Square wave operation, Switching Utilization. Harmonic reduction by programmed harmonic elimination switching, Forced Commutated Thyristor Inverters, Auxiliary Commutated (Mc-Murray) Inverter, Complementary Commutated (Mc-Murray-Bedford) inverter. Current Source Inverter, Single phase CSI Inverter Circuit Design

.

Reference Books

1. M. H. Rashid, Power Electronics-Devices, Circuits and Application, Prentice Hall of India, 2003.

2. N. Mohan, T.M. Undeland and W. P. Robbies, Power Electronics, Converters, Applications and Design, John Wiley and Sons, 2003.

BIEE-025: POWER SYSTEM PLANNING AND LOAD FORECASTING

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Forecasting-Needs uses and current status of forecasting- Fundamentals of quantitative forecasting- Explanatory and time serious forecasting-least square estimates- Peak load forecasting- Accuracy of forecasting methods. Regression methods- Box Jenkins time serious methods.

UNIT II

Problems facing electricity industry-Long term forecasting techniques-Methods of long term forecasting- spatial load forecasting- Multivariate procedures-Short term forecasting techniques-

UNIT III

Forecasting and planning. The role of forecasting in planning-Comparison and selection of forecasting methods _ The accuracy of forecasting methods- Pattern of the Data and its effects on individual forecasting methods- Time horizon effects on forecasting methods.

UNIT IV

Generation planning-Fundamental economic analysis-Generation planning optimized according to generating unit categories-distribution & Transmission system planning.

Reference Books:

1. Makridakis, Spyros, "Forecasting methods and application", John Wiley, 1993.
2. X.Wang & J.R. Mc Donald , "Modern Power system planning", McGraw. Hill, 1993
3. A.S Pabla , "Electrical Power system planning", Mac Millan,Delhi,1998
4. Sullivan, "Power system planning", McGraw. Hill ,1977
5. Lakervi E, E J Holmes, "Electricity distribution network design", IEE, 2nd edition, 2003

BIEE-026: ENERGY AUDITING & ANALYSIS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Electrical Systems: Supply & Demand Side, Economic operation, Input-Output curves, Load profiling-Energy Auditing-instruments for auditing- Specific Energy Consumption; ECO assessment and Evaluation methods; Energy Economics, Reactive Power, Power factor improvement-automatic controls, case study;

UNIT II

Energy Efficiency, Energy accounting, monitoring and control, Transformer Loading/Efficiency analysis, Feeder loss evaluation, Case study;

Lighting: Energy efficient light sources, Domestic/commercial/industrial lighting schemes & Controls, Energy conservation in Lighting Schemes, Luminaries, case study;

UNIT III

Electric Motors: Energy efficient control and starting, Load matching, Selection of Motors, Efficiency and Load Analysis, Energy efficiency /high efficiency Motors, case study;

Industrial Drives, Control Schemes, Variable speed drives and Energy conservation schemes, Pumps and Fans-Efficient Control strategies- Oversizing -case study;

UNIT IV

Electric loads of Air conditioning & Refrigeration, Energy conservation , case study;

Power Consumption in Compressors, Energy conservation measures; Electrolytic Process, Electric heating-Furnace operation and scheduling;

Cogeneration & Trigeneration Schemes-Optimal operation-Case study.

Reference Books:

1. IEEE Bronze Book- .Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities., IEEE Inc, USA,1995.

2. Albert Thumann, P.W, Plant Engineers and Managers Guide to Energy Conservation. – 7th Edition-TWI Press Inc, Terre Haute,1977.
3. Donald R. W., "Energy Efficiency Manual", Energy Institute Press
4. Partab H., "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Sons, New Delhi. Second edition
5. Tripathy S.C., "Electric Energy Utilization And Conservation", Tata McGraw Hill.,1993
6. Efficient use of Electricity in Industries-ECQ series, Devkai R &D Engineers, Vadodara, 2001
7. Turner, Wayne C., "Energy Management Handbook", 2nd ed. Lilburn, GA: The Fairmont Press Inc., 1993.
8. UNESCAP-.Guide Book on Promotion of Sustainable Energy Consumption. (www.unescap.org/enrd/energy)

BIEEL-013: LAB-XVII (POWER ELECTRONICS LAB)

Lecture	Tutorial	PRACTICAL	Credit	Marks
		2	**1**	External: 15+Internal:35 Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

1. SCR and TRIAC characteristic.

2. To measure the Latching and Holding Current of a thyristor.

3. To study the different triggering circuits for thyristor.

- Resistor triggering circuit.
- R-C triggering circuit
- UJT triggering circuit.

4. To study single phase firing circuit using COSINE wave scheme for triggering Thyristor in single phase bridge converter.

5. Study of 1-pulse converter with R and L load.

6. Study of 2-pulse converter with R and L load.

7. Study of three phase semi converter with R and R-L load.

8. Study of three phase full converter with R and R-L load.

9. Study of single phase dual converter.

10. Study of single phase cycloconverter.

11. To study different types of single phase Ac regulators

AC regulator using Triac.

AC regulator using thyristor connected in antiparallel.

12. To study different microprocessor based firing circuit and its application.

1. To study the Power MOSFET/IGBT chopper with varying Frequency and duty cycle.

2. DC Motor control by Impulse commutated single Quadrant chopper.

3. Study of different PWM Schemes:

   Single pulse.

   Multiple.

   Sinusoidal.

   Trapezoidal.

4. To study a Transistorized Single phase PWM inverter.

5. To study the IGBT based Single phase PWM inverter.

6. DC motor speed control by single phase semi converter and full converter.

7. Speed control of DC motor using three phase half controlled converter.

8. To study the closed loop control of DC motor.

9. To study the operation of four quadrant chopper with DC motor drive.

10. Speed control of three phase induction motor by using three phase IGBT PWM inverter

11. To study the closed loop control of three phase AC motor.

12. V/F speed control of three phase Induction motor.

Elective- I,II(Seventh Semester)

The student have to choose any two subjects from the following:

BIEEE-001: DYNAMIC SYSTEM SIMULATION

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Simulation of systems using MATLAB: MATLAB software environment . matrix operations . MATLAB functions . creation of m-files . Tool boxes . simulation of transfer functions . state models . inter-conversion of models . analysis in time domain and frequency domain using MATLAB functions - Case studies for typical systems Computer simulation of continuous time dynamic systems using transfer function models- electromechanical hydraulic and pneumatic systems. Simulation of discrete time and digital control systems.

UNIT II

Blockset based simulation-SIMULINK- Case studies for typical systems Computer simulation of continuous time dynamic systems using transfer function models- electromechanical hydraulic and pneumatic systems Simulation of discrete time and digital control systems.

UNIT III

Simulation of Power Electronic Circuits, Machines and Drives- Use of MATLAB and SIMULINK-Development of generalized machine models for induction motor. Simulation of Ward Leonard system of speed control. Simulation of induction motor driven from inverters.

UNIT IV

Statistical simulation : statistical models in simulation . discrete and continuous distributions- Poisson processes . empirical distributions- queuing models . characteristics of queuing systems. notation. performance measures .Markovian models . steady state behaviour of infinite population Markov models . single server queues with Poisson arrivals- Steady state behavior of finite population models. Simulation of AR, MA, ARMA processes.

Reference Books:

1. Narsingh Deo, . System Simulation with Digital Computer, Prentice Hall India, 1989
2. Graham C Goodwin, Stefan F Graebe, Mario E Salgado, Control System Design, Prentice Hall India, 2003
3. Richard C. Dorf and Robert H Bishop, Modern Control Systems, 8th Ed., Addison Wesley, 1998.
4. Karl J. Aström, Björn Wittenmark, Computer Controlled Systems: Theory and Design, 3rd Ed. Prentice Hall, 1997.
5. Douglas M. Considine, Process/Industrial Instruments & Control Handbook, 4th Ed., McGrawHill, 1993.
6. Jai P. Agarwal, Power Electronic Systems: Theory & Design, Pearson Education Asia, 2001.
7. P.C. Sen, Principles of Electrical Machines & Power Electronics, John Wiley, 2003.

BIEEE-002: DIGITAL CONTROL SYSTEM

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

1 **Signal Processing in Digital Control:**
Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modeling of sample-hold circuit., pulse transfer function, solution of difference equation by z-Transform method.

UNIT II

Design of Digital Control Algorithms:
Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

UNIT III

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

UNIT IV

Stability of Discrete System:
Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane. Lyapunou's Stability in the sense of Lyapunou,
stability theorems for continuous and discrete systems, stability analysis using Lyapunor's method.

UNIT V

Optimal digital control:
Discrete Euler Lagrange equation, max. min. principle, otpimality & Dynamic programming, Different types of problem and their solutions.

Reference Books:

1. B.C.Kuo, "Digital Control System",Saunders College Publishing.
2. M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill.
3. R.Leigh, "Applied Digital Control", Prentice Hall, International
4. C.H. Houpis and G.B.Lamont, "Digital Control Systems:Theory, hardware, Software",Mc Graw Hill.

BIEEE-004: MECHATRONICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

1. Mechatronics and its scope:
Sensors and transducers- Displacement, position & proximity, velocity, force, pressure and level. Signal conditioning amplification, filtering & data acquisition.

UNIT II

Pneumatic and Hydraulic actuation systems:
Directional control valves, pressure control valves and cylinders. process control valves. Mechanical actuation system-kinematic chains, cams, geartrains. Ratchet & Pawl, dampers, bearings. Electrical actuation system. Mechanical switches- solenoid operated solid state switches, DC, AC & stepper motors. Building blocks of Mechanical spring, mass and damper. Drives- Electrical Drives, Fluid systems, hydraulic, servo, closedloop controllers.

UNIT III

Elements of Microprocessors & Microcontrollers, Programmable **logic controllers &** Communication interface.

UNIT IV

Case Studies of Mechatronic Systems:
Industrial Robot and its control ,automobile Engine Control,Electromechanical disc-control.

UNIT V

Vehicle suspension Control:
Micro mechanical systems. Computer Printer, VCR, Fax Machine, NC Machine.

References Books:
1. Rolf Isennann, " Mechatronics Systems", Springer, 2005.
2. W. Bolten, "Mechatronics", Pearson Education 2003.
3. HMT Ltd, "Mechatronics:, Tata McGraw Hill 1998.

BIEEE-003: SPECIAL ELECTRICAL MACHINES

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT-I

Poly-phase AC Machines:

Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power)

UNIT-II

Single phase Induction Motors:

Construction, starting characteristics and applications of split phase, capacitor start, capacitor run, capacitorstart , capacitor-run and shaded pole motors.

Two Phase AC Servomotors:

Construction, torque-speed characteristics, performance and applications.

UNIT-III

Stepper Motors:

Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications.

Switched Reluctance Motors:

Construction; principle of operation; torque production, modes of operation, drive circuits.

UNIT-IV

Permanent Magnet Machines:

Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet ,dc motors, sinusoidal PM ac motors, brushless dc motors and their important features and applications, PCB motors. Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors; introduction to permanent magnet generators.

UNIT-V

Single Phase Commutator Motors:

Construction, principle of operation, characteristics of universal and repulsion motors ; Linear Induction Motors. Construction, principle of operation, Linear force, and applications.

Reference Books:

1. P.S. Bimbhra “Generalized Theory of Electrical Machines” Khanna Publishers.
2. P.C. Sen “ Principles of Electrical Machines and Power Electronics” John willey & Sons, 2001
3. G.K.Dubey “Fundamentals of Electric Drives” Narosa Publishing House, 2001
4. Cyril G. Veinott “Fractional and Sub-fractional horse power electric motors” McGraw Hill International, 1987
5. M.G. Say “ Alternating current Machines”Pitman & Sons

BIEEE-007: COMPUTER APPLICATIONS IN POWER SYSTEM

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Introduction- Digital computers in power system simulations, System view point, Hierarchy of transmission and distribution system, nature and scope of power system studies, Electric supply industry structure under Deregulation, Regulatory and policy developments. Power system components, representation of transmission lines. Transformers - Two winding and auto-transformers, tap changing transformer and loads

.

UNIT II

Graph Theory- Oriented graph, reference direction, system graph for transmission network, concept of graph theory, loop matrix, cutset matrix, incidence matrix, Topological relations, multiport representation, Bus impedance and Bus admittance matrix formulation, bus impedance algorithm

.

UNIT III

Load Flow Studies- Analytical formulation, methods of load flow solutions, Bus mismatch and convergence criteria, Gauss-Siedel method, Newton Raphson method, concept of decoupled methods

.

UNIT IV

Optimal Load Flow Study of Power System- Thermal system, transmission losses, optimum scheduling of thermal plants taking losses into account, economic load scheduling of hydro-thermal plants

UNIT V

Power system control and management – normal operation, abnormal operation contingency analysis and demand side management

Reference Books:

1. Electrical Energy Systems Theory -O.I.Elgerd
2. Computer Methods in Power system Analysis -A.H.El.Abiad
3. Understanding FACTS concept and Technology - Hingorani N.L.

BIEEE-008: FLEXIBLE AC TRANSMISSION SYSTEMS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

FACTS concepts and general system considerations: Power flow in AC systems - Definition of FACTS - Power flow control -Constraints of maximum transmission line loading - Benefits of FACTS Transmission line compensation- Uncompensated line -shunt compensation - Series compensation -Phase angle control.

UNIT II

Static shunt compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM - Compensator control - Comparison between SVC and STATCOM.
Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators - TCVR and TCPAR- Operation and Control -Applications.

UNIT III

Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPFC- Basic Principle of P and Q control- independent real and reactive power flow control- Applications - Introduction to interline power flow controller.

UNIT IV

Special purpose FACTS controllers - Thyristor controlled voltage limiter - Thyristor controlled voltage regulator - Thyristor controlled braking resistor - Thyristor controlled current limiter-

Custom Power - Compensation Devices - STS - SSC - SVR -Backup energy supply devices

Reference Books:

1 N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.

2 R. Sreeram Kumar (Ed) "Lecture Notes on Flexible AC Transmission Systems (FACTS)". Institution of Engineers (India), Calicut Local Centre, 2003.

3 K.S.Sureshkumar , S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut,2003

4 T.J.E. Miller. "Reactive Power Control in Electric Systems", JohnWiley & Sons, 1984.

BIEEE-009: DIGITAL CONTROL SYSTEMS DESIGN

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Basic digital control system- Examples - mathematical model-ZOH and FOH- choice of sampling rate- principles of discretisation-Mapping between s-domain and z-domain-Pulse transfer function- Different configurations for the design- Modified z-transform- Multi-rate discrete data systems.

UNIT II

Time responses of discrete data systems-Steady state performance- Correlation between time response and root locations in the z-plane-Jury's stability test –Root locus- Polar plots-Nyquist stability criterion- Bode plot- Bilinear transformation method and Routh stability criterion on the r-plane -Bode plot using bilinear transformation.

UNIT III

Cascade compensators using Root Locus- Design of PID controllers- Cascade compensation by continuous data controllers using bilinear transformation - Feedback continuous data controller-Two degrees of freedom compensation-Digital controller using bilinear transformation- Dead-beat response design- Deadbeat controller without and with prescribed manipulated variable-Choice of sample time for deadbeat controller-Realization of digital controllers. Computer based simulation.

UNIT IV

State variable model of discrete data systems with S/H devices- State transition equations- state diagrams- Transfer function- Transformation to Jordan canonical form and phase variable form-Computation of state transition matrix using Cayley-Hamilton theorem and z-transform method-Response between sampling instants- Controllability, Observability, stabilizability and reachability- Loss of controllability and observability due to sampling- Pole placement design using state feedback for SISO systems. Computer based simulation.

Reference Books

1. M.Gopal,Digital control and State Variable methods, Tata McGraw –Hill , 1997
2. B.C.Kuo, Digital Control Systems, 2nd Ed., Oxford University Press,1992.
3. Constantine H. Houpis and Gary B. Lamont, Digital control systems Theory, hardware software, Mc-Graw Hill Book Company, 1985.
4. R.Isermann, Digital control systems, Volume I, Fundamentals , Deterministic control,(2nd revised edition),Springer Verlag, 1989.
5. R.G.Jacquot, Modern digital control systems, (second edition),Marcel Dekker, Inc., 1995.
6. Philips and Nagle, Digital control system analysis and design, Prentice Hall, 1984.
7. G.F.Franklin, J.David Powell and M.Workman,Digital Control of Dynamic Systems, 3rd Ed.,,Addison Wesley, 2000.

BIEEE-010: POWER SYSTEM RELIABILITY

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Generator System Models- State Load Model- Probability Methods- Unit Unavailability- Outage Probability- Generating Capacity Limits- Recursive Techniques- Capacity Expansion Analysis - Scheduled Outages - Reliability Indices- Frequency Duration Method.

UNIT II (

Interconnected Systems - Two Systems with Tie- Probability Array Methods- Reliability Indices- Variable Reserve And Maximum Peak Load Reserve- Multi Connected Systems.

UNIT III

Operating Reserve- PJM Method - ORR - UC Risks - Economics & Reliability - Hot Reserve - Rapid Start Units- Security Function Approach.

UNIT IV

Distribution System- Interruption Indices- System Performance- risk prediction- Radial Systems- Effect Of Load Transfer- Line Failures- Parallel And Mesh Networks- Industrial Systems.

Reference Books:

1 Roy Billinton, Power System Reliability Evaluation., Plenum Press, New York,1991
2 Roy Billinton, Ronald N. Allan, Reliability Assessment of Large Electric Power Systems., *IEEE Press* 1995
3 R. Ramakumar, Reliability Engineering: Fundamentals and Applications, Prentice Hall, 1993
4 Roy Billinton, Ronald W. Allan and Luigi Salvaderi, Applied Reliability Assessment in Electric Power Systems. , *IEEE Press*, 1991
5 J. Endrenyi, *Wiley*, Reliability Modeling in Electrical Power Systems, New York, 1978

Elective- III,IV(Eighth Semester)

The student have to choose any two subjects from the following:

BIEEE-011: ELECTRIC ENERGY UTILIZATION

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Electric Traction: Features of an ideal traction system-systems of electric traction- mechanism of train movement- speed-time curve- traction supply system- transmission line to substation-feeding and distributing system on an ac traction- system of current collection-traction motors-tractive effort and horse power- Speed control Schemes-Electric braking.

UNIT II

Electric heating: classification- heating element-losses in oven and efficiency- resistance furnace- radiant heating- induction heating- high frequency eddy current heating- dielectric heating- arc furnace- heating of buildings-Electric welding:- methods and equipments-Electrolysis and Electroplating applications.

UNIT III

Illumination: radiant energy-terms and definitions- laws of illumination- polar curves-photometry- MSCP- integrating sphere- luminous efficacy- electrical lamps- design of interior and exterior lighting systems- illumination levels for various purposes- light fittings- factory lighting- flood lighting-street lighting-energy conservation in lighting.

UNIT III

Air conditioning and refrigeration: Control of temperature - protection of motors - simple heat load and motor calculations. Air-conditioning - function of complete air conditioning system - type of compressor motor. Cool storage - estimation of tonnage capacity and motor power. Technology of electric and hybrid electric vehicles.

References Books:

1. Taylor E Openshaw, "Utilisation of Electric Energy", Orient Longman,1986.
2. J B Gupta, "Utilization of electric power and electric traction", S K Kataria & Sons, 2002.
3. Wadhwa. C.L., "Generation, Distribution and utilization of electrical energy", Wiley Eastern Limited,1993.
4. Soni, Gupta, Bhatnagar, "A course in electric power", Dhanapat Rai & sons, 2001.
5. S.L.Uppal, "Electrical Power",Khanna pulishers,1988.
6. Garg and Girdhar, "Utilisation of Electric energy",
7. Partab H., "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Sons, New Delhi. Second edition
8. Tripathy S.C., "Electric Energy Utilization And Conservation", Tata McGraw Hill,1993 .
6. Web sites: bee-india.org, eia.doe.gov, www.irfca.org.
7. IEEE bronze book-IEEE press

BIEEE-012: ACTIVE FILTER DESIGN

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Filter Approximations: Introduction to Active Filtering- Review of OPAMP non-idealities - Categories of Filters- LP, HP, BP, BE and All Pass Filters- Second Order s-domain equations in each case and their pole-zero plots. The Filter approximation problem: - Butterworth Approximation- Chebyshev and Inverse Chebyshev Approximations- Elliptic Approximation- Bessel approximation- Phase and Group delay characteristics of approximation functions-delay equalizer functions, frequency transformations.

UNIT II

Single OPAMP Biquads : First Order LP,HP,BP, All Pass Filters- Biquad Topologies, Analysis and Design of Single OPAMP Biquads with finite gain . Analysis and design of LP, HP and BP Filter with second order response. Use of bridged T Network in Active Filters. . Sensitivity Analysis of Single OPAMP Filters

UNIT III

Multiple OPAMP Filters : KHN (Universal Active Filter) Filter, Tom-Thomas Biquad, Analysis

and Design for various categories of filters, Q Enhancement and pole frequency error problem,

Elementary ideas of compensation, Inductor Simulation, Antoniou Gyrators, LP,HP,BP and BE

Filters using Antoniou Gyrators**.**

UNIT IV

Structure for LP, HP, BP and BE SC Filters, Basic ideas of method of realization of higher order filters (RC and SC) other than cascading technique - Synthesis of LC ladder Networks using gyrators, frequency-dependent- negative resistors, as well as leapfrog techniques.

Reference books:

1 G. Daryanani, Digital and Analog Communication Systems, John Wiley and Sons, 1976
2 M.E Van Valkenberg, Analog Filter Design, Prentice Hall of India, 2004.
3 L.P Huelsman, Introduction to the Theory and Design of Active Filters, McGraw Hill, 1980
4 Roubik Gregorian and Gabor C, Analog MOS Integrated Circuits for Signal Processing, John Wiley and Sons, 1986

BIEEE-013: POWER QUALITY ISSUES AND REMEDIAL MEASURES

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Power Quality –overview of power quality phenomena -Basic terminologies –Power Quality Issues – Causes for reduction in Power Quality — Power Quality Standards and indices

UNIT II

Voltage sags-Causes of voltage sags – magnitude & duration of voltage sags – effect on drives and peripherals– monitoring & mitigation of voltage sags.

Interruptions -Origin of Long & Short interruptions – influence on various equipments – monitoring & mitigation of interruptions.

Harmonics-important harmonic introducing devices-SMPS-Three phase power converters-arcing devices-saturable devices-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

UNIT III

Power factor improvement- Passive Compensation- Passive Filtering- Harmonic Resonance - Impedance Scan Analysis- Active Power Factor Corrected Single Phase Front End-Control Methods for Single Phase APFC-Three Phase APFC and Control Techniques- PFC Based on Bilateral Single Phase and Three Phase Converter-static var compensators-SVC and STATCOM

UNIT IV

Active Harmonic Filtering-Shunt Injection Filter for single phase , three-phase three-wire and three-phase four-wire systems-d-q domain control of three phase shunt active filters -UPS-constant voltage transformers- series active power filtering techniques for harmonic cancellation and isolation . Dynamic Voltage Restorers for sag , swell and flicker problems.

Grounding and wiring-introduction-NEC grounding requirements-reasons for grounding-typical grounding and wiring problems-solutions to grounding and wiring problems.

Reference Books

1. G.T.Heydt, “Electric Power Quality”, Stars in a Circle Publications, 1991
2. Math H. Bollen , “Understanding Power Quality Problems”, IEEE Press, 1st Edition,2001
3. J. Arrillaga, “Power System Quality Assessment”, John Wiley, 2000
4. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood, Power system Harmonic Analysis, Wiley, 1997
5. Wilson E Kazibwe, Musoke H Sendaula, “Electic Power quality control techniques”, Van Nostrand Reinhold , NewYork,1993
6. J. Schlabbach,D. Blume,T. Stephanblome , “Voltage quality in Electrical Power Systems”, IEE, 2001

BIEEE-015: STOCHASTIC CONTROL SYSTEMS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Random Processes-Statistical Distributions-Gaussian Distribution - Elements of theory of stochastic process - Gauss-Markov sequence model - Gauss-Markov process model. Wiener process. Wiener filters.

UNIT II

Estimation prediction and filtering: Introduction to Estimation Theory- Mathematical estimation problem- Optimal estimation for discrete systems - optimal prediction for discrete linear systems - Optimal filtering for discrete linear systems - Optimal filtering in the presence time correlated disturbances and measurement errors.

UNIT III

Optimal smoothing: Optimal smoothing for discrete linear systems - Classification of smoothed estimates - Single-stage and double-stage optimal smoothing - Optimal fixed-interval smoothing - optimal fixed-point smoothing - optimal fixed-lag smoothing.

UNIT IV

Optimal control: Stochastic optimal control for discrete linear systems –LQG/LQR Problems- The stochastic linear regulator problem - separation principle- Stochastic optimal control for continuous linear systems - Formulation of continuous filtering equation as a special case of discrete filtering equations.

Reference Books

1. J. S. Meditch, .Stochastic Optimal Linear Estimation and Control., McGraw-Hill.
2. B. D. O. Anderson, .Optimal Filtering., Prentice Hall.
3. A.P. Sage, .Optimum Systems Control., Prentice Hall.
4. Guanrong Chen, Goong Chen, Shih-Hsun Hsu, Linear Stochastic Control Systems, CRC Press, 1995
5. Athanasios Papoulis, Probability, Random Variables, and Stochastic Processes, McGraw Hill, 1984.
6. John B. Thomas, Introduction to Applied Probability & random Processes, John Wiley, 1971.

BIEEE-014: COMPUTER CONTROL PROCESS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	**1**	**--**	**4**	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Multiple loop systems- Improved control through multiple loops- Cascade control- Selective control loops . Feed forward control- Ratio control- adding feedback- economics- interaction and decoupling- Relative gain analysis- Effects of interaction- Response to disturbances- Decoupling- Introduction to batch process control.

UNIT II

Multivariable control- Basic expressions for MIMO systems- Singular values- Stability norms- Calculation of system norms- Robustness- Robust stability- H^2 / H^∞ Theory- Solution for design using H^2 / H^∞ - Case studies.

UNIT III

Programmable logic controllers- Organization- Hardware details- I/O- Power supply- CPU- Standards- Programming aspects- Ladder programming- Sequential function charts- Man-machine interface- Detailed study of one model- Case studies.

UNIT IV

Real time systems- Real time specifications and design techniques- Real time kernels- Inter task communication and synchronization- Real time memory management- Computer Control of Industrial Processes-Control hierarchies for plant level automation-Microprocessor/microcontroller/DSP based control-PC based control-Distributed Control Systems-Control Networks-Protocols-Ethernet-Field Bus-Man-Machine Interface.

Reference Books

1. Shinskey F.G., Process control systems: application , Design and Tuning, McGraw Hill,1988.
2. Be Langer P.R. , Control Engineering: A Modern Approach, Saunders College Publishing , 1995.
3. Richard C. Dorf and Robert H Bishop, Modern Control Systems, 8th Ed., Addison Wesley, 1998.
4. George L Batten Jr., Programmable Controllers: Hardware, Software and Applications, McGraw Hill, 1994.
5. Laplante P.A., Real Time Systems: An Engineer's Handbook, Prentice Hall of India, 2002.
6. Constantin H. Houpis and Gary B. Lamont, Digital Control Systems, McGraw Hill,1985.
7. Karl J. Aström, Björn Wittenmark, Computer Controlled Systems: Theory and Design, 3rd Ed. Prentice Hall, 1997.
8. Douglas M. Considine, Process/Industrial Instruments & Control Handbook, 4th Ed., McGrawHill, 1993.
9. Graham C Goodwin, Stefan F Graebe, Mario E Salgado, Control System Design, Prentice Hall India, 2003.
10. Donald R. Gughanowr, Process Systems Analysis and Control, 2nd Ed., McGrawHill, 1991.
11. Curtis D Johnson, Process Control Technology, 8th Ed, Prentice Hall India, 2006.

BIEEE-018: ADVANCED POWER ELECTRONICS

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Gate Turnoff Thyristor (GTO) .Power BJTs . Power MOSFETs - Insulated Gate Bipolar Transistors (IGBTs) - Basic Structure and I-V Characteristics.

UNIT II

Line Frequency Phase-Controlled three phase Rectifiers - Half Wave and Full Wave Controlled Rectifier with various kinds of loads. Half Controlled and Fully Controlled Bridge circuits - Input Line Current Harmonics and Power Factor- Inverter Mode of Operation .

Three Phase Square Wave /Stepped Wave Inverters. Three Phase SPWM Inverters. Effect of Blanking Time on Inverter Output Voltage. Selective Harmonic Elimination Method.

UNIT III

Current Regulated Inverter -Current Regulated PWM Voltage Source Inverters. Hysteresis Control - Areas of application of Current Regulated VSI. Switched Mode Rectifier - Operation of Single/Three Phase Bridges in Rectifier Mode. Control Principles. Special Inverter Topologies - Current Source Inverter. Analysis of Single Phase Capacitor Commutated CSI.

UNIT IV

Power Factor Control - Shunt Reactive Power Compensators. Switched Capacitors. Static Reactor Compensators based on thyristors . Static Reactive VAr Generators using PWM Current Regulated VSIs. Active Power Filtering. Harmonic Generation by PE Equipment. Harmonic Pollution Standards. PWM Current Regulated VSI based implementation of a Single Phase Active Power Filter.

Reference Books

1. Ned Mohan et al ,Power Electronics, John Wiley and Sons, 1989.
2. Rashid .Power Electronics, Prentice Hall India,1993
3. G.K.Dubey et.al , Thyristorised Power Controllers, Wiley Eastern Ltd, 2001.
4. G.K. Dubey & C.R. Kasaravada, Power Electronics & Drives, Tata McGraw Hill, 1993.
5. B. K Bose, Modern Power Electronics and AC Drives, Pearson Education (Asia), 1992.
6. Dewan & Straughen, Power Semiconductor Circuits, John Wiley & Sons, 1984.
7. IETE Press Book, Power Electronics., Tata McGraw Hill
8. Cyril W Lander, Power Electronics,1993

BIEEE-016: INDUSTRIAL DRIVES

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

UNIT I

Fundamentals of electric drives - block diagram of an electric drive - parts of electric drives - dynamics of electric drives - torque equations - speed torque conventions - loads with rotational motion - loads with translational motion - components of load torque - load equalization - control of electrical drives - closed loop control - current limit control - speed sensing - current sensing - phase locked loop speed control

UNIT II

Dc motor drives - constant torque and constant power control - single phase controlled rectifiers with motor loads - fully controlled and half controlled rectifier fed dc drives - continuous and discontinuous operation - Four quadrant operation - three phase controlled rectifier fed dc drives - dual converter fed control - chopper fed dc drives - closed loop speed control schemes - solar and battery powered drives - braking of dc drives

UNIT III

Three phase induction motor drives - AC voltage controlled drives - variable frequency control - VSI fed induction motor drive - operation with field weakening - CSI controlled induction motor drives - slip power recovery scheme - rotor resistance control - single phase induction motor drives - PWM drives

UNIT IV

Synchronous motor and brushless dc motor drives. Operation from fixed frequency supply-variable frequency control - VSI and CSI fed drives- self-controlled synchronous motor drives employing cycloconverter - brushless dc motor drives for servo applications

Reference books

1. Ned Mohan et al, Power Electronics: Converters, Applications, and Design, John Wiley & Sons. Inc., 2nd Edition, 1995.
2. G.K Dubey, Fundamentals of electric Drives., 2nd Edition, Narosa Publishing Company, 1994/1995 .
3. S.K.Pillai, Electric Drives, University Press India, 1993
4. William and Hulley, Power Electronic devices and motor control, 2nd Edition, 1995.
5. Werner Leonhard, Control of electrical drives, Springer, 1995.

BIEEE-017:ADVANCED CONTROL SYSTEM

Lectures	Tutorials	PRACTICAL	Credits	Marks
3	1	--	4	External: 70+Internal: 30. Students are required to score 45% marks individually in both External & Internal and 50% marks in total.

Unit-I

State Space Analysis of Continuous System:
Review of state variable representation of continuous system, conversion of state variable models to transfer function and vice-versa, solution of state equations and state transition matrix, controllability and obsrvability, design of state observer and controller

Unit-II

Analysis of Discrete System:
Discrete system and discrete time signals, state variable model and transfer function model of discrete system, conversion of state variable model to transfer function model and vice-versa, modeling of samplehold circuit, solution of state difference equations, steady state accuracy, stability on the z-plane and Jury stability criterion, bilinear transformation, Routh-Hurwitz criterion on rth planes

Unit-III

Stability:
Lyapunov's stability theorems for continuous and discrete systems, methods for generating Lyapunov function for continuous and discrete system, Popov's criterion.

Non linear System:
Types of non linearities, phenomena related to non - linear systems.
Analysis of non linear systems-Linearization method, second order non-linear system on the phase plane, types of phase portraits, singular points, system analysis by phase-plane method, describing function and its application to system analysis.

Unit-IV

Optimal Control:
Introduction, formation of optimal control problem, calculus of variations minimization of functions, constrained optimization.Pontryagin's Minimum Maximum Principle, Linear Quadratic Problem-Hamilton Jacobi equation, Riccati equation and its solution.

Unit-V

Adaptive Control:
Introduction, modal reference adaptive control systems, controller structure, self tuning regulators. Introduction to neural network, fuzzy logic and genetic algorithms

Reference Books:

1. M.Gopal, "Digital Control and State variable Methods", Tata Mc Graw Hill
2. Ajit K.Madal, "Introduction to Control Engineering: Modelling, Analysis and Design" New Age International.
3. D.Landau, "Adaptive Control", Marcel Dekker Inc.
4. S.Rajasekaran & G.A.Vjayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Alogorithms: Synthesis and Applications" Prentice Hall of India.
5. Donald E. Kiv, "Optimal Control Theory: An Introduction" Prentice Hall
6. B.C. Kuo, "Digital Control Systems" Sounders College Publishing
7. C.H.Houpis and G.B.Lamont,"Digital Control Systems:Theory,Hardware, Software"Mc Graw Hill.

BIEEP-003 : PROJECT WORK IN SEMESTER VII & VIII

In project work group of maximum five students will work in a team for a common defined objective.

Project work must be done in consultation with the industries and industrial needs. Students are expected to visit any industry of their liking for selection of industrial projects/problems. They will prepare document defining the problem clearly. The final draft and scope of project will be decided by students in consultation with the internal and external (industry expert) guide.

They will train themselves to solve above defined problem if necessary. Once the final draft and scope of project is defined they can work on project with that industry.

Student will complete project work in two phases (two semesters) and they will prepare presentation of project work carried out in these semesters and present it as ***Project Seminar –I and II*** in respective semesters. It is expected that students should complete following work as follows

Semester- VII	**Semester- VIII**
Visit to industry/ study of a specific problem. Define a problem. Finalize the scope and nature of work. Submit the synopsis. Train themselves (if necessary) Prepare a rough report containing following 1. Introduction 2. Literature survey 3. Need and justification of work. Finalize the report.	Prepare a rough report containing following 4. Experimental work/ testing/design/ fabrication. 5. Results 6. Discussion 7. Conclusions 8. Scope of future work. 9. References Finalize the report.
Prepare presentation based on above and present it as ***Project Seminar –I***	Prepare presentation based on total work and present it as ***Project Seminar –II***

Credit Guidelines

There will be 8 credits assigned to the project work.

Oral/ PRACTICAL Examination

In this, students are expected to prepare for external oral examination. Students will be assessed by the external examiner which is either appointed by university or by industrial expert (may be called from industry having work experience in the field in which project is completed). As far as possible, same external examiner will assess group of students for project in two semesters. This will ensure involvement of examiner and proper evaluation of project work. The evaluation of the Project is to be carried out of 200 marks only in eighth semester and no evaluation will be carried out in seventh semester.