GUJARAT UNIVERSITY
B.E. SEM III (ELECTRICAL ENGINEERING)

E-301 MATHEMATICS II

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Mathematics II	E-301	04	0	Sessional	1½ Hrs	50	0	0	150
				University	3 Hrs	100			

1. Vector calculus :
Reorientation, differentiation of vectors, scalars and vector fields. Gradient of a scalar function. Directional derivative, Divergence and Curl of a vector function and their physical meanings. Line, surface and volume integrals, Green's, Gauss's and Stoke's theorems (without proof), Irrotational, Solenoid and conservative vector fields, orthogonal curvilinear coordinators (Cylindrical and Spherical polar).

2. Fourier series :
Periodic functions, Dirichlet's conditions, Fourier series, Euler's formulae, Fourier expansion of periodic functions with period 2π, Fourier series of even and odd functions, Fourier series of periodic functions with arbitrary periods, Half range Fourier series, Harmonic analysis.

3. Laplace transforms :
Motivation, Definition, linearity property, Laplace transforms of elementary functions, shifting theorem, Inverse Laplace transforms, Laplace transforms of derivatives and integrals, Convolution theorem, Application of Laplace transforms in solving ordinary differential equations, Laplace transforms of periodic, Unit step and Impulse functions.

4. Integral transforms :
Fourier integral theorem (only statement), Fourier sine and cosine integrals, Complex form of Fourier integral, Fourier sine and cosine transforms, Inverse laplace transforms by method of residues. Solutions of boundary value problems using Fourier transforms.

5. Matrices:
Caley-Hamilton's theorem, Special matrices like Hermitian, Skew-Hermitian and Unitary. Reduction to diagonal form, Quadratic forms.

6. Higher Order differential equations :
Linear differential equations of higher order with constant coefficients, Method of variation of parameters, Higher order linear differential equations with variables coefficients (Cauchy's and Legendre forms), Simultaneous linear differential equations, Models for the real world problems and their solutions in particular, modelling of electric circuits.

Reference Books :

1. Erwin Kreyszig : Advanced Engineering Mathematics (8^{th} Edition) Wiley Eastern Ltd., New Delhi.
2. Dr. K.R. Kachot : Higher Engineering Mathematics**,** Vol-II Mahajan Publishers, Ahmedabad.
3. Dr. B.S. Grewal : Higher Engineering Mathematics Khanna Publishers, New Delhi.
4. N.P. Bali, Ashok Saxena & Iyengar : A Text book on Engineering Mathematics Laxmi Publications (P) Ltd., New Delhi.
5. H.K. Dass : Advanced Engineering Mathematics

S. Chand & Co. (Pvt.) Ltd., New Delhi.
6. G.V. Kumbhojkar : Engineering Mathematics – Vol. I, II, III, IV
Jamnadas & Co. Bombay

GUJARAT UNIVERSITY
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E-302 ELECTRICAL POWER GENERATION

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Power Generation	E-302	04	0	Sessional	1½ Hrs	50	0	0	150
				University	3 Hrs	100			

1. **Steam power station :** Schematic arrangement, advantages and disadvantages, choice of site, efficiency of steam power station, Types of prime movers, characteristic, speed control & auxiliaries. Environmental aspects for selecting sites and locations of thermal power stations.
2. **Hydro power station :** Schematic arrangement, advantages and disadvantages, choice of site constituents of hydro power plant, Hydro turbine. Environmental aspects for selecting sites and locations of hydro power stations.
3. **Diesel power station :** Schematic arrangement, advantages and disadvantages, I.C. engines
4. **Nuclear power station :** Schematic arrangement, advantages and disadvantages, selection of site, types of reactors, Hazards Environmental aspects for selecting sites and locations of nuclear power stations.
5. **Gas turbine power plant :** Schematic arrangement, advantages and disadvantages.
6. **Combined cycle power plant :** Comparison of various power plants.
7. **Solar energy fundamental and Solar thermal power plant :** Solar energy routes and prospects, merits and limitations of solar energy conversion and utilization, Types of solar thermal collectors, comparison between conventional and solar thermal power plant, ratings of solar power plant heat transfer fluids, solar pond and binary cycle solar thermal power plant.
8. **Geothermal energy fundamentals Geothermal electric power plant :** Applications, utilization of geothermal energy, Geothermal energy resources, origin of geothermal resources, Classification and types of geothermal power plants, liquid dominated geothermal electric power plant, binary cycle liquid dominated geothermal power plant, geo thermal energy power plant, scope for geothermal energy in India.
9. **Wind energy fundamentals Wind power plants :** Applications, Merits and demerits of wind energy, nature and origin of wind, variables in wind energy conversion system, wind velocities and height from ground and site selection, types of wind energy system, wind turbine generator unit with battery storage facilities, wind turbine generator unit with diesel generator, solar wind hybrid, wind farm sitting, wind map of India, wind electric station in India. Wheeling arrangements.
10. **Fuel Cell and Fuel Cell power plants :** Introduction, concept, types, Electrochemical Reactions, Hydrogen, Oxygen Fuel cells, Phosphoric Acid Fuel cells, Molten Carbonate Fuel cells, Methanol fuel cells, Medium temperature, fuel cell, configuration of power plant, Performance Characteristics, Fuels, Commercial plants in the world.
11. **Magneto hydro Dynamic Power generation :** Principles, MHD Systems, Advantages of MHD Systems, Electrical conditions: Voltage and Power output of MHD generator.
12. **Bio mass energy resources :** Bio mass energy resources, bio mass conversion process, raw bio mass materials for conversion to biogas, agriculture waste and agriculture energy crops and fruit farms.
13. **Ocean energy:** Ocean energy resources, advantages and limitations of ocean energy conversion, technologies, ocean thermal energy conversion, principle of OTEC, open cycle OTEC, modified open cycle OTEC plant, closed cycle OTEC, OTEC conversion plants in India.
14. **Tidal energy conversion :** High and low tides, tidal energy conversion, tidal power, details about plant and equipments, tidal power plants in the world, tidal energy resources in India.

References:

[1] Energy Technology by S. Rao & Dr. B.B.Parulekar
[2] Renewable energy sources and conversion technology by N.K. Bansal
[3] A Course in electrical power by Soni & Bhattnagar

GUJARAT UNIVERSITY
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E-303 ELECTRICAL & ELECTRONICS MEASURING INSTRUMENTS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Prac t	Exam	Theory Paper	Theory Marks	Prac t	TW	Total
Electrical & Electronics Measurement	E-303	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Introduction:
Measurements; Methods of measurement:- Direct and Indirect, Classification of Instruments:- Deflection, Null Analog and Digital. Voltage Standards, Induction Standards, Resistance Standards, Capacitance Standards. Units and dimensions in S.I. system, measurement of absolute values of current and resistance, standard batteries, characteristics of instruments- definitions true value accuracy precision, error, sensitivity and resolution.

2. Analog Ammeters And Voltmeter :
Analog instruments ; classification of analog instruments; principle of operation, various operating forces, PMMC, Moving Iron, Moving Coil, Dynamometer type, Induction type, Thermocouple, Hot Wire, Electrostatic, Rectifier type.

3. Galvanometer :
D'Arsonaval Galvanometer:- Construction, Torque equation, Dynamic behaviour. Ballistic Galvanometer:- construction, Theory, calibration.

4. Wattmeter & Energy meter :
Electrodynamometer Wattmeter :- Construction, Theory, shape of scale, Errors. Low power factor Wattmeter. Measurement of power in three-phase circuits. Three phase wattmeter. Measurement of Reactive power. Energy meter for A.C. circuits :- Theory of Induction type meters, single phase Induction type watt-hour meter:- Construction, theory, operation, lag adjustment, friction compensation, creep and errors. Maximum Demand indicator.

5. Electronics Instruments :
Introduction , Electronic Voltmeters , Digital Voltmeter Vacuum tube Voltmeters (VTVMs) , Differential amplifier , Differential amplifier type of Electronic Voltmeter , D.C. Voltmeter with direct coupled amplifier , Electronic voltmeters using Rectifiers. True R.M.S. reading voltmeters. Electronic Millimeters , Electronic ohmmeters , Considerations in selecting an analog voltmeter , Differential voltmeter , Vector voltmeter , A.C. Voltage measurements , Current measurements using Electronic Instruments , D.C. & A.C. current measurements. Advanced Electronic Energy measurement., digital tachometer.

6. AC. & D.C. potentiometers :
DC potentiomter -Basic, cromptons,standard cell dial, true zero, Brooks deflection potentiometer, voltage ratio box, application of potentiometer. AC potentiomter , Standardising of A.C. potentiometer, Types A.C. potentiometer. Drysdale polar A.C. potentiometer, Gall Tinsley, Quadrature, Adjustments of currents, Application of A.C. potentiometer.

7. C.R.O. :
Introduction, Block diagram, delay line, special types of CROs

8. Special Instruments :
Working principle & use of Special Instruments such as Maximum demand indicator , Trivector meter , analog tachometer. Synchroscope, Weston frequency meter , p.f. meters , Phase sequence indicator Analog tachometer, Frequency meters.

Reference Books:

[1] Elect. Meas. & Meas. Instruments: E.W. Golding
[2] Elect. & Electronic Measurements & Instrumentation - A.K..Sawhney.
[3] Modern Electronic Instrumentation & Measurement Techniques – W.D. Cooper, Albert D. Helfrick

GUJARAT UNIVERSITY
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E-304 NETWORK ANALYSIS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Network Analysis	E-304	4	2	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Network elements:
Basic relationship, current and voltage relationship, work, power and energy consideration.

2. Network topology:
Definitions, tie set schedule and cut set tables, source transformation, dot convention, principle of duality.

3. Network equations:
Mesh/loop current and node voltage analysis, equations for coupled circuits, Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by Laplace transforms, transient analysis of R-L, R-C circuits and R-L-C circuits.

4. Network theorems:
Thevenin, Norton, Superposition, Millman, Reciprocity and Maximum power transfer theorem.

5. Impedance functions:
Concept of complex frequency, transform impedance and transform circuits.

6. Network functions:
For one port and two ports, calculation of network functions, poles and zeros, time domain behavior, Two-port parameters, relationships of two port variables, admittance, impedance, transmission and hybrid parameters, relationship between parameters sets, series/ parallel combinations of two port networks.

7. Properties of positive real function, necessary and sufficient conditions, basic synthesis procedure, synthesis of L-C, R-L and R-C driving point functions.

Reference Books:

[1] Network analysis-M.E. Van Valkenberg.
[2] Network analysis-G.K. Mithal
[3] Network synthesis-ME. Van Valkenberg.
[4] Network analysis-Rao

GUJARAT UNIVERSITY
B.E. SEM III (ELECTRICAL ENGINEERING)

E - 305 LINEAR ELECTRONICS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Linear Electronics	E-305	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Band Theory and Energy level diagrams :** Semiconductors – Intrinsic and Extrinsic, Free charge carriers
2. **P.N. junction diode:** Rectifier diode, switching diode, breakdown diode, varactor diode, solar cells, photo detector, light emitting diode.
3. **Rectifying circuits and D.C. power supplies :**Half, full wave and bridge rectifiers and their analysis, principles of 3-phase rectifiers and filter circuits diode as clipper and clamper, zener diode as a voltage regulator.

4.Transistor : Basic transistor amplifier, CB, CE, CC configuration characteristics and analysis, phototransistors.

5. Transistor biasing and thermal stability: Stability factors, collector to base bias, emitter bias, voltage divider bias, bias compensation.

6. Transistor heat dissipation: Heat sink and thermal dissipation.

7. Transistor h - parameter circuits: General idea of h parameters and their applications in each configuration of amplifiers.

8. Low and high frequency response of transistor amplifier.

9. Negative feedback amplifiers: Voltage shunt and voltage series amplifier.

10. Transistor oscillators and Multivibrators : Effect of positive feedback, R.C. phase shift oscillator and Wien bridge oscillator, transistor as a switch, transistors as multivibrators (astable, bistable, monostable).

11. Transistor amplifiers: Class A, class B and Push-pull amplifier.

12. JFET and MOSFET: Types, their characteristics and applications.

Reference Books:

[1] Electronic Devices and circuits; An introduction - Allen Mottershed
[2] – R. S. Sedha
[3] - Sanjeev Gupta

GUJARAT UNIVERSITY
B.E.II SEM III (ELECTRICAL ENGINEERING)

E-306 Computer Techniques for Network (Lab only)

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Computer Techniques for Network (Lab only)	E-306	0	2	Sessional	---	0	25	25	50
				University	---	0			

1. Introduction to Matlab and Pspice.
2. Solving simultaneous equations.
3. Kirchoff's current and voltage laws and series-parallel resistive circuits.
4. Node and Loop Analysis.
5. Source Transformation.
6. Network Theoroms.
7. Laplace Transforms.
8. Frequency Response Analysis.
9. Fourier Analysis.
10. Two port Networks.
11. Circuit Analysis using Pspice.

Reference Books:

1.Linear Circuit Analysis by Raymond A. Decarlo and Pen-min Lin, Oxford University Press.
2.Fundamentals of Electrical Engineering by Leonard S. Bobrow, Oxford University Press.
3.Getting Started with Matlab 6, Rudra Pratap. Oxford University Press.
4. Circuit Analysis by A. Bruce Carlson, Thomson Publishers.

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E-307 ELECTRICAL WORKSHOP – II (Lab only)

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Workshop-II	E-307	0	2	Sessional	--	0	0	50	50
				University	--	0			

1. **Construction ,Working and application of special workshop tools.**
2. **Assembling and disassembling of Heating appliances like-Iron, Geysers ,Immersion Heater, Room Heater, Ovens.**
3. **Assembling and disassembling of motorized appliances like- fan, Mixers, Refrigerator, Air condition, Vacuum cleaner**
4. **Construction , Working And fault finding using Megger.**
5. **Study of Different types of Lamps.**
6. **Assembling and disassembling of lighting Fixtures.**
7. **Transformer rewinding**
8. **Earthing Practice.**
9. **Safety rules.**

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E-401 ELECTRO MAGNETICS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electro Magnetics	E-401	04	01	Sessional	1½ Hrs	50	0	25	175
				University	3 Hrs	100			

1. Vector analysis:

Vector algebra-Cartesian coordinate system, vector components-unit vectors, dot and cross product, circular, cylindrical and spherical co-ordinate systems, transformation of systems.

2. Coulomb's law :

Coulomb's law, electric field intensity, field of n-point charges, field due to line charge, continuous volume charge and sheet charge.

3. Gauss' law and Divergence :

Electric flux density, Gauss law, application divergence, Maxwell's first equation, vector operator and divergence theorem.

4. Energy & potential:

Energy in moving a point charge in electric field, potential and potential difference, potential gradient, and the dipole.

5. Conductors, dielectrics & capacitance:

Current and current density, continuity of current-conductors and semiconductors, dielectric, capacitance. Boundary conditions for perfect dielectric materials

6. Poisson's and Laplace's equations

7. Magnetic Field :

Biot savart's law, Ampere's law, curl, Stokes theorem, magnetic flux and flux density, magnetic potential, derivation of magnetic field's laws.

8. Magnetic forces. Materials & Inductance :

Force on moving charge and differential current element, Nature of magnetic materials, permeability, boundary conditions, magnetic circuit and inductance.

9. Faraday's laws :

Faraday's laws. Maxwell's equations in point form and integral form.

10. Uniform planewave and Electromagnetic Wave Propagation.

11. transmission line theory.

12. Electromagnetic Interference & Compatibility

13. Applications.

REFERENCE BOOKS.

[1] Engineering electromagnetics – William Hayt Jr.
[2] Elements of Engineering Electromagnatics –N. Narayan Rao

[3] Elements of Engineering Electromagnatics – Sadiku (Oxford)

GUJARAT UNIVERSITY
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E- 402 CONTROL THEORY

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Control Theory	E-402	04	01	Sessional	1½ Hrs	50	0	25	175
				University	3 Hrs	100			

1. Introduction to control systems:

Introduction to control systems ,classification of control systems, The Open-loop control systems & Closed -loop control systems ,comparison of Open-loop control systems & Closed -loop control systems, servomechanism, examples with applications in engineering field.

2. Mathematical models of Physical systems:

Differential equations of physical systems ,Mechanical systems, electromechanical systems , Translational elements, Rotational elements, Electrical systems, transfer function, analogous systems, block diagram reduction techniques signal flow graph. Masons gain formulae, , gear trains :Design and applications.

3. Time response analysis:

Standard test signals, time response of first order and second order control systems, time domain specifications, Steady state error and error constants, compensation methods.

4. Stability:

Concept of stability, necessary conditions, Hurwitz criterion, Routh criterion, relative stability analysis, applications to control systems.

5. Root Locus techniques:

Root locus concept, construction of root locus, determination of relative stability.

6. Frequency response analysis:

Introduction correlation between time and frequency response, polar plots. Bode plots, phase margin gain margin, Principle of argument,Nyquist stability criterion, assessment of relative stability.

7.Introduction to Control System Design:

Introduction to Control System Design, P, PI & PID controllers, Introduction to pole placement and its effect on stability.

8. Control systems and components :

Comparison between ordinary motor and servo motor, T.F of servo motors:1) Field controlled D.C servo motor, 2) Armature controlled D.C servo motor, 3)Two phase A.C servo motor. applications and transfer functions of D.C. and A.C. servomotors, synchros, tacho generator **.**Introduction to stepper motors & its applications. Problems

Reference Books:

1. Control systems engineering by I.J. Nagrath/N. Gopal
2. Feedback Control Systems by Dr. S D Bhide
3 Linear control systems by B.S.Manke
4 Automatic control system by S Hasan saeed

List of Experiments :

1 To study characteristic and transfer function of DC servo motor
2 To study of PID controller
3 Time response of second order system
4 Steady state error constant for TYPE- 0,TYPE-1,& TYPE-2 system
5 Study of AC Servo stabilizer
6 Study of Potentiometer as an error detector system
7 Speed-torque characteristic of AC servo motor
8 Study of differential Synchro

9 Study of Synchro-Transmitter & Receiver systems
10 Study of Stepper motor controller
11 Study of DC position servo system

GUJARAT UNIVERSITY
B.E.II SEM IV (ELECTRICAL ENGINEERING)

E-403 POWER SYSTEM - I

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Power System-I	E-403	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Distribution:

Types & comparisons, overhead & under ground transmission, cables and their types & their construction.

2. Conductors:

Types of conductors- A.C.S.R. conductor, Bundle conductor

3. Insulators:

Types, string efficiency, capacitor grading

4. Mechanical design of transmission line:

Sag calculation, supports at equal and unequal levels, stringing chart

5. Transmission line parameters:

Inductance of 1-phase, two-wire line and composite conductor lines, inductance of 3-phase line with symmetrical and unsymmetrical spacing with and without transposition, double circuit line, bundled conductors, resistance and skin effect, capacitance of 1-phase and 3-phase transmission line, effect of earth on transmission line capacitance. performance calculation of short line, medium line by nominal T and Π method, evaluation of A,B,C,D constants, long transmission lines – rigorous solution, Ferranti effect.

6. Substation Equipments and layout of bus bars

7. Performance Analysis:

Representation of power systems components :One line diagram and impedance/reactance diagram, per unit system representation, Power circle diagram, receiving end and sending end power circle diagram, universal circle diagram. Consideration of effect of low power factor, Advantages of power factor improvement,- methods of improving power factor, the most economical power factor.

8. Neutral Ear thing:

Introduction, isolated neutral, earth neutral systems-solid, resistance, reactance. Arc suppression coil, voltage transformer and earthing transformer, earthing systems.

9. Enviornmental aspects for selection of outdoor substation.

10. Safety precautions in indoor and outdoor substations.

Reference Books :

[1]Elements of power system analysis —Stevenson
[2] Modem power system analysis — Nagrath & Kothari
[3] Electrical power — Dr. S.L. Upal
[4.]A course in electrical power — Soni, Gupta and Bhagtnagar.

GUJARAT UNIVERSITY
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E-404 ELECTRICAL MACHINES – I

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Machines-I	E-404	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Principles of Electromechanical Energy Conversion :

Energy in magnetic system, Field energy and mechanical force : Direction of mechanical force, Determination of mechanical force, mechanical energy, Flow of energy in electromechanical devices. Multiply excited magnetic field systems.

2. D.C. Machines :

Principle of D.C. generator and motor, construction, types of generators, E.M.F. equation, voltage build up process, critical resistance and speed , characteristics of generators, performance equation and efficiency, effect of armature reaction on terminal voltage, Type of motors, torque equation, characteristics, losses and efficiency, starters : Necessity of starter, Three point & four point starter. Introduction to soft starter. Speed control : Ward Leonard method, Basic concept of Static speed control of DC machines. Armature reaction and commutation.

Losses in dc machines, efficiency.

3. Transformer :

Construction and principle of **single-phase transformer**, operation at no load and on load, vector diagram, equivalent circuit, losses, efficiency and regulation, determination of regulation and efficiency by direct load test and indirect test methods, **Polyphase transformers** Polarity, star/star, star/delta, delta/delta, delta/zigzag, terminal marking, nomenclature, vector diagram, phase groups, parallel operation, Scott connection, tertiary winding, auto transformers testing of transformers - efficiency - transients in transformers - voltage regulation - off load and on load tap changers.

Reference Books :

[1] Electric Machines – Nagrath Kothari
[2] Performance & design of dc, machine –Clayton
[3]Performance & design of ac machine –M.G.Say
[4] Elect. Technology Vol. II - B.L. Theraja

GUJARAT UNIVERSITY
B.E.II SEM IV (ELECTRICAL ENGINEERING)

E- 405 INTEGRATED ELECTRONICS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Integrated Electronics	E-405	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1.Operation Amplifier:
Introduction Block diagram representation of a typical op-amp, Analysis op-amp ICC circuits, types, designations, packages, pin configurations and power supplies.

2. Operational amplifier:
Ideal op-amp, equivalent circuit, open loop op amp configurations of differential, inverting and non-inverting amplifiers, op amp feedback amplifier analysis, differential amplifier with one, two and three op amps.Op amp parameters - offset voltages and currents, bias current, drift, PSRR, CMRR, offset nulling methods.

3. AC performance:
Bandwidth, slew rate and frequency response. Op-amp applications: DC and AC amplifiers, peaking, summing scaling and averaging amplifiers, instrumentation amplifier, differential input and differential, output amplifier, V to I and I to V converters, integrator, differentiator comparator, non-linear amplifier, phase shift oscillator, Wien bridge oscillator, square, triangular and sawtooth wave generator, voltage controlled oscillator, zero crossing detector, window detector, introduction to analog simulation.

4. Active filters:
Basic low and high pass filters, band pass and notch filters.

5. Timers:
555 timer 1C, monostable, bistable, astable operations, their industrial applications.

6. Phase locked loop:
Operating principle, 5651C, basic applications.

7. Voltage regulators:
Three terminal regulator ICs, basic block schematic - 78 x x & 79 x x series - Adjustable output voltage regulator LM 317, LM 340 and LM 337 series power supply ICs. their use and basic design considerations for designing regulated power supplies.

8. Power amplifier IC. - LM 380

9. Number System: Binary, Octal, Hexadecimal and their conversions, Binary Arithmetic, Representation of negative numbers and floating point numbers

10. Basic logic gates, truth table Boolean algebra, Karnaugh map, simple basic combinational logic circuits. Flip flops - S.R, D-types, J.K. & Master slave.

Reference Books :

[1] Op Amp and Linear integrated Circuit technology - Ramakant A gayakwad.
[2] Operational Amplifiers and Linear integrated circuits - Robert F. Coughlin, Frederick F. Driscoll
[3] – A. Anand Kumar.
[4] Digital Electronics - An introduction to Theory and practice, by William H.Gothmen.

GUJARAT UNIVERSITY
B.E.II SEM IV (ELECTRICAL ENGINEERING)

E- 406 COMPUTER TECHNIQUES FOR CONTROL THEORY (Lab only)

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Computer Techniques for control theory (Lab only)	E-406	0	02	Sessional	---	0	25	25	50
				University	---	0			

List of practical:

1. Introduction to computer software for Control system analysis.
2. Introduction to computer software for control system simulation.
3. Solution of simple differential equation.
4. Creation of mathematical models of LTI control system and manipulation of it.
5. Getting time response of first order system for different types of input using simulink
6. Getting time response of second order system for different types of input using simulink
7. Plotting root locus and thereby study of system performance.
8. Plotting Bode plots and thereby study of system performance.
9. Plotting Nyquist plots and thereby study of system performance.
10. Design Case study.

Reference books:

1. Modern Control Theory : Ogata
2. Getting Started with Matlab 6.5, Rudra Pratap.
   Oxford University Press
3. Programming with MATLAB - Stephen Chapman
4. Control system tool box manual
5. Simulink manual.

GUJARAT UNIVERSITY
B. E. SEM V (ELECTRICAL ENGINEERING)

E 501 ELECTRICAL MACHINES – II

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Machines-II	E-501	03	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Polyphase Induction Motor :-

Introduction working principle, Classification of AC motors, Synchronous Speed, speed of rotor field, slip, Various methods of measurement of slip, starting & running torque, torque-slip characteristics, maximum torque, effect of change in voltage & frequency on torque, speed & slip, power across air gap, torque & power output, efficiency, No-load & blocked rotor test, equivalent circuit, Phasor diagram, circle diagram, Efficiency and slip scale with the help of circle diagram, Analogy of an I.M. to a transformer, torque & power by use of Thavenin's theorem, effect of rotor resistance on performance of I.M.,Double cage squirrel cage IM and its eqivilent circuit, Induction machine dynamics.

Principles & Methods of speed control of 3- phase I.M. & starting of I.M., Electrical transients in induction machine, magnetic levitations, Principle, advantages & application of linear induction motor, Effect of harmonics, harmonic torques, effect of unbalance voltages & frequency variation on operation of I..M. Testing of induction motor as per IS, Energy efficient motors. Induction Generator, its load and p. f. control.

2. Armature Windings:-

DC windings : Simplex & Duplex windings, Lap & Wave windings, Basic terms related to armature windings, Dummy Coils, Equalizer connections, split coils.

AC windings : Introduction, No. of phases, Phase spread, concentric winding, hemitropic winding, whole coil winding, mush winding, double layer windings, integral slot lap and wave winding. Fractional slot lap & wave windings. Performance analysis of various windings.

3. Single phase A. C. motors :

Types of single phase motors, 1-phase induction motor, Double field revolving theory, Equivalent circuit of 1-phase induction motor, starting & running performance of 1-phase ind. Motor, symmetrical component concepts, split phase, Resistance start, Capacitor start and capacitor start & run induction motor, shaded pole induction motor, fractional horse power motors.

4. Commutator motors :

Action of commutator as a frequency converter, construction and principles of following commutator motors : Repulsion motor, Scharge motor, AC series motor, Universal motor.

Term work and minimum 10 Practicals shall be based on the above syllabus.

Visit: Industrial visits of relevant industries.

BOOKS:-

(1) Electric machines by D.P.Kothari & I.J.Nagrath. (Tata Macgraw Hill)
(2) Electric Machinery by P. S. Bhimra
(3) Electric Machinery by Fitzgerald & Kingsley
(4) Performance & Design of A.C.Machines by M.G.Say
(5) Performance & Design of A.C. commutator motors By E. O. Taylor
(6) Electric machines, drives by Theodore- Wildi
(7) Induction machines by B.V.Jayawant (Macgraw Hill)
(8) Electrical Machine design – A. K. Sawhney
(9) Electrical Technology- H. Cotton

GUJARAT UNIVERSITY
B. E. SEM V (ELECTRICAL ENGINEERING)

E 502 BASIC MICROPROCESSORS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Basic Microprocessors	E-502	03	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Introduction:**
   Development of different Microprocessors-8 bit and 16 bit, concept of digital computers, block diagram and organization of digital computers.
2. **8085 Microprocessor :**
   Architecture, functional overview, pin configuration and memory interfacing. Introduction to 8085 programming model, instruction classification, instruction format
3. **8085 Assembly language Programming:**
   Instructions, Addressing modes, 8085 Assembly language programming.
4. **8086/ 8088 microprocessor:**
   Architecture Pin diagram, functions of different pins in MIN & MAX mode, Bus Interface Unit (BIU) & Execution Unit (EU), functions of various units like ALU, Control unit, different registers, register queue and their use, Memory organization, MIN & MAX mode operation of 8086.
5. **8086 Assembly language programming:**
   Addressing modes, Types of instructions, Programming, Stack operation, String operation & I/O operation. Creating and assembling source code, hand assembling, Machine assembling, Hardware & Software system developments tools.
6 **Subroutine and stack operations:** Concept of stack, stak pointer (SP), stack related instructions , PUSH – POP. Subroutines & it's related instructions CALL - RET instructions of Intel 8085/ 8086 Microprocessors.
7. **Comparative study of various Intel Microprocessors:**
   8085, 8086, 80286, 80386, 80486 , Pentium & Pentium pro microprocessor.

Term work and minimum 10 Practicals shall be based on the above syllabus.

BOOKS:-

1. Microprocessor Architecture Programming and Application with 8085
   R. S. Gaonkar, Penram Publication
2. The 8088 & 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications: Walter A. Tribel & Avatar Singh Pearson/ PHI Publication
3. Microprocessor & Interfacing- Programming & Hardware-
   Douglas hall, TMH Publication
4. PC Assembly Language Programming-Peter Able By Pearson/ PHI Publication.
5. Fundamentals of Microprocessors and Microcomputer
   B. Ram, Dhanpat rai & Sons

GUJARAT UNIVERSITY
B. E. SEM V (ELECTRICAL ENGINEERING)
E-503 Industrial instrumentation

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Industrial Instrumentation	E-503	03	01	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1 Transducers:
Introduction to instrumentation system, static and dynamic characteristics of an instrumentation system, Principles and classification of transducers, Electrical transducers, basic requirements of transducers

2 Strain Gauge and Strain Measurement:
Factors affecting strain measurements, Types of strain gauges, theory of operation of resistive strain gauge, gauge factor, types of electrical strain gauges, strain gauge materials, gauging techniques and other factors, strain gauge circuits and temperature compensation, applications of strain gauges.

3 Displacement Measurement:
Resistive potentiometer (Linear, circular and helical), L.V.D.T., R.V.D.T. and their characteristics, variable inductance and capacitance transducers, Piezo electrical transducers-output equations and equivalent circuit, Hall effect devices and Proximity sensors, Large displacement measurement using synchros and resolvers, Shaft encoders.

4 Forces and Torque Measurement:
Load cells and their applications, various methods for torque measurement. Use of torque wrenches

5 Pressure Measurement:
Mechanical devices like Diaphragm, Bellows, and Bourdon tube for pressure measurement, Variable inductance and capacitance transducers, Piezo electric transducers, L.V.D.T. for measurement of pressure, Low pressure and vacuum pressure measurement using Pirani gauge, McLeod gauge, Ionization gauge, Pressure gauge calibration.

6 Flow Measurement:
Differential pressure meter like Orifice plate, Venturi tube, flow nozzle, Pitot tube, Rotameter, Turbine flow meter, Electro magnetic flow meter, hot wire anemometer, Ultrasonic flow meter.

7 Level Measurement:
Resistive, inductive and capacitive techniques for level measurement, Ultrasonic and radiation methods, Air purge system (Bubbler method).

8 Temperature Measurement:
Resistance type temperature sensors – RTD & Thermister, Thermocouples & Thermopiles, Different types of Pyrometers. Humidity measurement and Moisture measurement techniques.infrared guns

9 Recorders:
X - Y, strip chart and circular type graphic recorders - indicating, recording and controlling instruments, multichannel recorders. Introduction to digital recorder.

10 Digital Data Acquisition systems & control :
Use of signal conditioners, scanners, signal converters, recorders, display devices, A/D & D/A circuits in digital data acquisition. Instrumentation systems. Types of Instrumentation systems. Components of an analog Instrumentation Data – Acquisition system. Multiplexing systems. Uses of Data Acquisition systems. Use of Recorders in Digital systems. Digital Recording systems. Modern Digital Data Acquisition system. Analog Multiplexed operation, operation of sample Hold circuits.

Term work and minimum 10 Practicals shall be based on the above syllabus.

BOOKS:-

1. Industrial Instrumentation & Control by S. K. Singh.
2. Electrical and Electronics Measurement and Instrumentation, A. K. Shawney
3. Transducers and Instrumentation , Patranabis
4. Mechanical & Industrial Measurements by R. K. Jain

5. Industrial Instrumentation by Rangan, Sharma, Mani
6. Transducers and Instrumentation , Murthy

Probable List Of Practicals

1) Measurement of Strain using Strain gauge.
2) Measurement and control of temperature using RTD.
3) Measurement of linear displacement using L.V.D.T.
4) Measurement of flow using Ultrasonic flow meter.
5) Measurement and control of temperature using Thermocouple.
6) Measurement of angular displacement using capacitive transducer.
7) Measurement of flow and velocity using Manometer pitot tube.
8) Measurement and control of temperature using Thermister.
9) Measurement of weight using column type load cell.
10) Measurement of differential pressure using differential pressure transducer.
11) Measurement of force / load using Piezo electric transducer.

GUJARAT UNIVERSITY
B. E. SEM V (ELECTRICAL ENGINEERING)

E- 504: DIGITAL & power electronics

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Digital & Power Electronics	E-504	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1 Thyristors:
Construction, working, two transistor analogy, operational characteristic, Turn on & turn off characteristics, Series Parallel operation, Triggering methods ,di/dt and dv/dt protection, Design of Snubber Circuit, Parameters of SCR.

2 Triggering Devices & Thyristor family:
LASCR, UJT, PUT, DIAC, TRIAC based Triggering circuits, IGBT, IGCT, MCT, SUS, SBS, GTO - operation, characteristic & construction

3 IGBT:
Construction and V-I characteristic, Switching characteristic, Losses, Parallel connection of IGBT, Protection and Gate drive circuits of IGBT

4 Control Rectifier:
Single half wave/ full wave rectifier with R, RL and RLE load, Free wheeling diode, Three phase half wave / full wave rectifier, six pulse rectifier

5 A. C. Voltage controller and Cyclo converter:
Single and Three phase controller with R & RL load, Zero voltage switching, Dual , Converter

6 Thyristor Commutation:
Basic definitions, Natural commutation, Forced commutation, Conditions for commutation, Types (Class A -F), Commutating circuits, AC line commutation, Jone's commutation circuit

7 Combinational logic circuits:
SOP & POS representation, K map, Design of arithmetic circuit, Design of code converter, 5 & 6 variable K map.

8 Logical Design Using MSI Circuit:
Multiplexer and their application in Combinational Logic Design, Adders and their application, BCD adder, Decoder/Driver for display devices, Application of Flip Flop, working of shift register 7496 and bi directional register, Concept of three state register, Ripple and synchronous counter, 3 bit counter, Modulus of counter Up & Down counter, Application of 7490 as decade converter

9 Introduction to Logic Family:
Introduction to TTL, CMOS, I^2 L, ECL, logic families and their comparative study

Term work and minimum 10 Practicals shall be based on the above syllabus.
Visit: Industrial visits of relevant industries.

BOOKS:-

1 Power Electronics By M. D. Singh
2 Power Electronics By P. S. Bimbhra
3 Power Electronics By M. S. Jamil Asghar
4 Modern Digital Electronics By R. P. Jain
5 Digital Electronics By Morris Mano
6 Digital Electronics By Malvino
7 Power Electronics Circuits & Application By M H Rashid
8. Digital Electronics by A. Anand Kumar

GUJARAT UNIVERSITY
B. E. SEM V (ELECTRICAL ENGINEERING)

E 505 ELEMENTS OF ELECTRICAL DESIGN & COSTING

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elements of Electrical Design and Costing	E-505	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Fundamental of Magnetic Circuit:**
   Basic principles of magnetic circuits – use of B-H curves in magnetic circuits – Calculations of MMF for air gap and teeth – Real and apparent flux density – Effect of saturation – flux density distribution – calculation of magnetizing current – Field Form – Introduction – carter's fringe curves – flux plotting – air gap flux distribution factor (field form factor) – actual flux distribution factor, Magnetising current calculation, Leakage Reactance calculation for various types of slots, Iron loss calculation concepts.
2. **Design of Electromagnets:**
   Introduction – Types of Electromagnets – Design of Magnet coils – Problems on above topics – Design of small Flat-faced armature type circular magnet – Design of large-faced armature type circular magnet – Design of Horse shoe type magnet – Design of plunger type magnet – Design of magnetic clutches
3. **Design of starters, field regulators & control panels:**
   A.C. and D.C. starters, field regulator and general purpose control panels.
4. **Design of small Transformers and Choke coils:**
   Design of Small single-phase transformers – Design of welding transformers –
   Design of variable air gap single-phase choke coil
   Design of variable air gap three-phase choke coil
   Design of ballast
5. **Estimating&Costing for Residential,Commercial &Service Connections (1- ø &3-ø)**
   Tenaments , Row houses , Bungalows , Flats , Multi – Storied Buildings ,Internal Wiring Estimation (Length of wire) Commecial Complexes like Offices , Hospitals , Hotels , Theatres . Internal Wiring Estimation (Length of wire) , Lighting Series & Hordings .
6. **Design consideration of Electrical Installation**
   Types of load , Electrical Supply Systems , Wiring systems , Load Assessment , Permissible voltage drops & Conductor size calculations , Control panel , Illumination Schemes.
7. **Estimating & Costing of Earthing**
   Residential , Equipment , Industrial , Commercial , Sub-station , Feeders.
8. **Estimating & Costing of Feeders & Industrial Sub-station**
   Overhead & Under ground feeder – 11 KV , 33 KV Indoor & Outdoor sub-stations , Sub – stations with different Power rating for 11 KV/415 V
9. **Estimating & Costing of L.T. Distribution & Street – lighting**
   Devices – Supports , Cross arms , Stay set , Guard wires , Conductors , Insulators.
   Street – light Lamps , Rural , Sub-urban , Urban & Metropolitan cities, Working and trouble shooting of lamps & luminaries.
10. **Tender Form**
    Guidelines for Inviting Tenders , Specimen Tender.

Term work and minimum 5 drawing sheets and sketches shall be based on the above syllabus.

BOOKS:-

[1] Electrical Estimating & Costing **By N. Alagappan & S. Ekambaram** (TTTI , Madras) - (Tata mcgrawhill Ltd)
[2] Electrical Estimating & Costing **By Surjit Singh** (Dhanpat Rai & sons)
[3] Electrical Machine Design **by A. K. Shawney**
[4] Electrical Design , Estimating & Costing **By K.B.Raina & S.K.Bhattacharya** (TTTI , Chandigarh) – (Wiley Eastern Ltd.)
[5] Electrical Installation , Estimating & Costing **By J.B. Gupta** (S.K.Kataria & Sons
[6] Electrical Machine Design **by R. K. Agrawal**
[7] Electrical Machine Design **by V. N. Mittle**

[8] Electrical Machine Design **by S. K. Sen**
[9] Electrical Machine Design **by Gray A.**

GUJARAT UNIVERSITY
B. E. SEM V (ELECTRICAL ENGINEERING)

E-506 Electrical & Electronics Measurements

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical & Electronics Measurement	E-506	03	01	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1 **Errors in measurement work :**
Classification of errors as Gross , Systematic , random errors & their remedies. Statistical analysis applied for the purpose of quality control. Concept of probability error, accuracy , precision , precision index Limiting error & class of accuracy. Introduction to the use of IS specifications in measurement work.

2. **Mearurement of resistance**
Classification of resistance, Measurement of low resistance-methods,kelvin's double bridge Measurement of medium resistance- ammetervoltmeter method, substitution method, wheastone bridge, Measurement of high resistance-difficulties in mearurement of high resistance,direct deflection method,loss of charge method, megger,ohmmeter.

3. **Magnetic measurements:** Flux Meter:- construction, operation, use of shunt with flux meter. Measurement of flux density, magnetising force, magnetic potentiometer, Testing of Ring specimen, Testing of Bar specimen. Determination of B.H. curve, A.C. magnetic testing

4. **AC Bridge measurement :** Concept of Inductance , mutual inductance & capacitance , Loss angle & quality factor. Measurement of self inductance by Maxwell's bridge Anderson's bridge & Hay's bridge, Measurement of mutual inductance by Maxwell's bridge. De sauty 's bridge & modification , Schering bridge for measurement of capacitance. Wein's bridge for the measurement of an imperfact capacitor. Principle & working of digital LCR meter.

5. **Instrument Transformers :** Construction of current transformers. Determination of ratio & phase angle errors. Effect of change in burden & power factor on the ratio & phase angle of CTs. Precautions while using a CT. CT testing requirements & equipment as per IS. Construction of Potential Transformers. Determination of ratio & phase angle errors of PTs. Effect of change in burden & burden power factor on the ratio & phase angle of PTs. Absolute & comparison methods of testing a PT. PT testing requirements & equipment as per IS. Idea about knee point voltage, accuracy class. Sealing of CT by neutral gas.

6. **Location of cable faults :**
Blavier test , Earth overlap test , Voltage drop test , Murray loop test . Varley loop test, Test for open circuit fault in cables.

7. **Wave analysers and Harmonic distortion :**
Introduction - basic wave analyser - frequency selective wave analyser - hetrodyne wave analyser - harmonic distortion analyser - spectrum analyser Signal conditioning – introduction - basic instrumentation amplifier - applications of instrumentation amplifiers - chopped and modulated dc amplifiers – modulators

Term work and minimum 10 Practicals shall be based on the above syllabus.

BOOKS:-

(1) Electrical Measurements & Measuring Instruments by Golding & Widdis (Wheeler's student edition)
(2) Electrical & Electronics Measurements & Instrumentations by A.K.Sawhney (Dhanpat Rai & sons)
(3) Electrical & Electronics Measurements by H. S. Kalsi (T M Hill).
(4) Electronics Measurements & Instruments by Helfric Coopour.
(5) Transducers & Instrumentation by Moorthy.

GUJARAT UNIVERSITY
B. E. SEM VI (ELECTRICAL ENGINEERING)

E- 601: ELECTRICAL MACHINES – III

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Machines-III	E-601	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Synchronous Machines:

Basic concepts, Elementary Machines, 3-phase generators, generated emf, Harmonics in voltage waveforms, MMF of distributed windings, rotating magnetic field, Torque, Operations, Magnetic leakage, Machine efficiency, Rating and loss dissipation, Basic synchronous machine model, Circuit model, Armature reaction and it's compensation, Short circuit ratio, Effect of increase in excitation, Effect of change in torque and speed, Determination of Synchronous reactance, regulation by Synchronous Impedance, MMF and Potier and AIEE methods, Synchronizing to infinite busbar, Operating characteristics, Power flow equations, Capability curves, Two reaction model of Salient pole machines, Parallel operations, Load sharing between generators, Effect of unequal voltages & percentage impedance, Governor characteristics, Hunting, Short circuit transients, single phase generators, Slip test for measurement of Xd and Xq, Sudden short circuit of Synchronous machine. Methods of starting of synchronous motors, Different torques in Synchronous motor, Stability, Synchronous condenser, Synchronous phase modifiers, V-curves and O-curves of Synchronous motors.

2 Auto Synchronous Motor

Construction, principle of operation, equivalent excitation current for different rotor connections, circle diagrams,

3 Special Machines

Special synchronous motors : Hysteresis & Reluctance motor. Miniature motors, Automobile electric systems. Induction Regulator, Induction Generator, Inverted Induction machine, Boosters & Balancers, AC & DC Servo motors. Permanent Magnet Materials : Characteristics, B-H loop and demagnetization characteristics, Residual flux density, Coercivity, Concepts of Maximum energy product and its unit MGO (Mega Gauss Orsted), Recoil line, Minor loop, temperature effects. Applications of PM materials. Permanent Magnet Machines: General construction, working and applications of following PM machines : PMBLDC motors, PM synchronous motors, Axial flux PM machines and Doubly salient PM machines. Switched Reluctance Motor: General construction, working and applications of SRM

Term work and minimum 10 Practicals shall be based on the above syllabus.

Visit: Industrial visits of relevant industries.

<u>BOOKS</u>:-

1. Electrical Machines by Nagrath & Kothari
2. Performance and Design of A C machines by M G Say
3. Electrical Machinery by P S Bhimbhra
4. Electrical Machines by Chakravorti & Mukharaji
5. PM and Reluctance Motor Drives By T. J. E. Miller Clarendon Press Oxford.
6. Electric Motor Drives by R. Krishnan PHI
7. Principles of Electrical Machines and Power Electronics By P. C. Sen

GUJARAT UNIVERSITY
B. E. SEM VI (ELECTRICAL ENGINEERING)

E- 602: MICROPROCESSOR INTERFACING AND APPLICATIONS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Microprocessor Interfacing and applications	E-602	03	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Interrupts:** Interrupt & Interrupt service routines, IRET instruction, Interrupt sequence, Layout of interrupt pointers, Hardware & Software Interrupts, Multiple interrupts, device Polling, vectored interrupts, Interrupt controller 8259

2. **Design of delay routines :** Their uses in designing counters, Reading input signals In Real time applications, Programmable Timer/Counter 8253.

3. **Peripheral Controllers for 8085/8086 family:** Memory interfacing and mapping, the 8255 Programmable Peripheral Interface (PPI), the 8251A Universal Synchronous/Asynchronous Receiver/Transmitter (USART), The 8237/8257 DMA Controllers, Interfacing of simple LEDs, 7 segment display LEDs, keys. Key debounce techniques /Keyboard / display interfacing using 8279. Interfacing to LCD and external memory.

4. **Interfacing Data converters**D to A converter : R - 2 R ladder network type DAC, DAC interfacing e.g. DAC 0800, Generation of waveforms using DAC. Realization of A to D converter using D to A converter. DAC and ADC specifications.. A to D converter : Different types of A to D conveter, sample and hold circuit, analog multiplexer, Interfacing of ADC 0800, multiplexer AM3705, S/H LF 398, ADC 0808/ADC 0809, ADC 0816, ADC 1210/ADC 1211 and similar.

5. **Data Communication Standards:** RS 232 Serial Interface Standard, The IEEE 488-1978 General Purpose Interface Bus (GPIB) Standards, Error detection & Correction. Introduction to working of USB, I2C.

6. **Applications**: Microprocessor based systems for measurement of electrical quantities like KVA, KVAr, KW, KWh, Power factor, Impedances, Introduction to MP based protective relays and control of electrical drives, process control systems as temperature, flow etc., Condition monitoring of Electrical Apparatus using Microprocessors.

Term work and minimum 10 Practical shall be based on the above syllabus.

BOOKS:-

1. The 8088 & 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications By Walter A. Tribel & Avatar Singh PHI Publication
2. Microprocessor & Interfacing- Programming & Hardware- Douglas hall, TMH Publication
3. Fundamental of microprocessors and microcomputers by - B.Ram. Dhanpat Rai & Sons.
4. Microprocessor Architecture Programming and Application with 8085
   R. S. Gaonkar, Penram Publication
5. Digital Computer Electronics Malvino

GUJARAT UNIVERSITY
B. E. SEM VI (ELECTRICAL ENGINEERING)

E-603: HIGH VOLTAGE ENGINEERING

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
High Voltage Engineering	E-603	03	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Corona:** Phenomenon, disruptive and visual critical voltage, corona loss, factors and conditions affecting corona loss , radio interference, methods to reduce corona.
2. **Breakdown mechanism in gases:** Introduction, ionization processes, townsend's mechanism, primary and secondary ionization co-efficient, breakdown in electronegative gases, Streamer theory, comparison of townsend and slepian's theory, Paschen's law, breakdown under uniform and non-uniform fields, post breakdown current-voltage characteristics, de-ionization, breakdown under impulse voltage, SF6 and vacuum as di-electric, vacuum BID mechanisms.
3. **Breakdown Mechanism in Liquids and Solids:** Introduction, classification of liquids, liquid breakdown test cell, transformer oil purification, testing of di-electric oil as per IS 355 and IS 6792, breakdown in pure liquids , breakdown in commercial liquids, solid di-electrics, intrinsic breakdown, electromechanical breakdown, thermal breakdown, electrochemical breakdown, treeing and tracking phenomenon of partial discharge, solid di-electrics used in practice.
4. **Generation of high voltage:** Introduction, Generation of high direct voltage, rectifier circuits, voltage doubler, cascaded circuits, deltatron circuits, van de graff generators, electrostatic generators, generation of high alternating voltages, cascade transformer, resonant transformer, generation of high frequency alternating voltages, generation of impulse voltages, standard impulse voltage wave, BIL, impulse generator, Marx circuit, constructional features of impulse generator, trigatron gap, faraday cage, generation of impulse currents.
5. **Measurement of high voltage and current :** Measurement of high direct voltages, potential dividers, generating voltmeters, measurement of high alternating voltages, series voltmeters, capacitance potential dividers and capacitance voltage transformers, electrostatic voltmeter, measurement with sphere gaps (IS 1876) , sphere gap construction and assembly, factors influencing the sparkover voltage, measurement of impulse voltages, measurement of high d.c. and a.c. currents., measurement of high frequency and impulse currents, measurement of capacitance and loss tangent.
6. **High voltage testing of equipments:** Introduction, related Indian standards, high voltage test on line insulators, bushings, transformers, cables, circuit breakers, lightning arrestors. Synthetic testing, non-destructive high voltage test, partial discharge detection, partial discharge measurement (IS 6209).
7. **High voltage laboratory:** Design, planning and layout of high voltage laboratory , necessity , test facilities , testing equipments , layout of short circuit laboratory, its circuit and operation.
8. **Safety precautions for H.V. laboratries.**

Term work and minimum 10 Practicals shall be based on the above syllabus.

Visit: Industrial visit of relevant industries.

BOOKS:-

(1) High Voltage Engineering by M.S. Naidu & V.Kamaraju, TMH Limited
(2) High Voltage Engineering by D.V. Razevig, translated by M.P. Chourasia , Khanna Publishers.
(3) High Voltage Engineering by Sabir Ray
(4) High Voltage Engineering Fundamentals by E. Kuffel and W.S. Zaengl- Pergamon Press

GUJARAT UNIVERSITY
B. E. SEM VI (ELECTRICAL ENGINEERING)
E-604: POWER ELECTRONICS

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Power Electronics	E-604	03	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1 Inverter:
Thyristor class, Single phase & Three Phase full bridge line commutated inverter circuit, Parallel capacitor commutated inverter circuit and their analysis, PWM inverter, Mc Murray inverter, Bed ford inverter, Current source inverter, Voltage source inverter, Voltage controlled inverters

2 Chopper:
Classification of chopper, Force commutated chopper, Thyristor based chopper, Thyristor voltage chopper, Jone's chopper, Voltage commutated and Current commutated chopper, Load commutated chopper

3 Introduction to Speed Control of A. C. & D. C. Motor:
Speed torque characteristics of different motors, Converter for feeding motors,

4 Speed Control of D. C. Motor:
Armature voltage control, Armature current control, VDR method, Saturable reactor method, Speed control using chopper, Soft starter for D. C. motor

5 Speed Control of A. C. Motor:
Basic principle, Variable voltage and variable frequency control, Variable current variable frequency control, Slip power recovery control, chopper control of rotor circuit of slip ring induction motor, Introduction to vector control of induction motor

6 Braking :
Dynamic braking and regenerative braking for phase controlled drives and chopper drives, Transient systems

7 Application:
Basic principle of ac and dc breaker using thyristors, battery charging dimmer controls, excitation systems of alternators, UPS, SMPS, Static switches.

Term work and minimum 10 Practicals shall be based on the above syllabus.
Visit: Industrial visit of relevant industries.

BOOKS:-

1. Electric Drive Concepts and Applications by Vedam Subramaniam
2. Modern Power Electronics and A. C. Drives by B. K. Bose
3. Electric Motor Drives by R. Krishnan
4. Industrial & Power Electronics by H. C. Rai
5. Electric Drives by S. K. Pillai
6. Power Electronics by M.S.Jamil Asghar
7. Power Electronics and Introduction to drives by A.K.Gupta and L.P.Singh

7 Power Electronics Circuits & Application By M H Rashid

8. Power Electronics By Ned Mohan

GUJARAT UNIVERSITY
B. E. SEM VI (ELECTRICAL ENGINEERING)

E 605 ELECTRICAL POWER SYSTEM – II

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Power System-II	E-605	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Review of representation of power system components:
Introduction, Single phase solution to three phase system, one line diagram, impedance and reactance diagram, Per unit system, Complex power, Synchronous machine, Representation of load

2. Symmetrical Fault Analysis:
Introduction, Short circuit analysis of synchronous machine, short circuit analysis of synchronous machine, selection of circuit breakers, algorithm for short circuit studies.

3. Symmetrical components:
Introduction, Symmetrical Component transformation, Phase shift in star delta transformers, Sequence impedances & sequence network of transmission lines, synchronous machine, transformers. Sequence network of total power system.

4. Unsymmetrical Fault Analysis :
Introduction, symmetrical components analysis of unsymmetrical faults, single line to ground fault, line to line fault, double line to ground fault, open conductor fault

5. Voltage control :
Methods of voltage control, shunt capacitor and reactor, synchronous condenser, tap changing transformer, booster transformer, voltage controls at different levels of power system such as consumer, distribution, transmission and generation ends.

6. Power system economics :
Introduction, classification of costs, cost analysis of power plant, interest and depreciation methods of determination of depreciation, economics of power generation, significance of load factor and diversity factor, load sharing between base load and peak load plants, choice of size and number of generating units, type of tariffs, type of consumer and their tariffs, power factor, disadvantage of low p.f. and it's causes, methods of Power factor improvement, advantage of power factor improvement, economics of PFI, optimum p.f.

7. Power System Transients :
Introduction, circuit closing transients, sudden symmetrical short circuit of alternator, recovery of transients due to removal of short circuit, traveling waves, wave equation, surge impedance, wave velocity, specifications of traveling waves, reflections and reflection of wave, line terminations, equivalent circuit of traveling wave studies, forked lines, reactive termination, Bewley lattice diagram, attenuation and distortion, arcing grounds , lightning phenomenon, Wilson's and Simpson's theory, overvoltages due to lightning, line design.

Term work and minimum 10 Practicals shall be based on the above syllabus.
Visit: Industrial visit of relevant industries.

BOOKS:-

(1) Modern power system analysis By Nagrath & kothari TMH limited 4/e-
(2) Electrical power system By C L Wadhwa, New Age International
(3) Power system analysis and design By B. R. Gupta-S. chand publishers
(4) Elements of Power System Analysis By Stevenson, Mc Graw Hill
(5) Power System Analysis By Hadi Saadat
(6) A text book of power system engineering –Soni, Gupta, Bhatnagar, Chakrabarthi.
(7) Power system analysis and design : Glover & Sharma Thomson Learning
(8) Power systems analysis By - Bergen & Vittal

GUJARAT UNIVERSITY
B. E. SEM VI (ELECTRICAL ENGINEERING)

E 606 BUSINESS ORGANIZATION & MANAGEMENT

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Business Organization & Management	E-606	03	00	Sessional	1½ Hrs	50	00	00	150
				University	3 Hrs	100			

1. **Production :**
   Division of labour. Efficiency of labour Scale of production. Economics of scale. Special importance of small-scale industries in developing countries like India.
2. **Forms of Business organization:**
   Sole proprietorship, partnership and joint stock company.
3. **Management :**
   Basic elements of process of management (its functions) systems approach to management. Evolution of management thought and principles.
4. **Personnel management :**
   Functions of personnel department. Man power planning and administration: recruitment, selection and placement, training and development. Industrial relations.
5. **Marketing management :**
   Modem concept of marketing. Marketing mix. Product mix and product planning. Sales forecast and techniques of forecasting sales. Business promotion techniques.
6. **Financial management & Cost accounting :**
   Capital requirements for different purposes. Sources of finance.. Role of Govt. & non-Govt. agencies such as GIDC , DIC , GSFC , GIIC , Banks . Capital budgeting process. Evaluation of alternative investment opportunities. Break-even analysis. Basic information about balance-sheet and profit and loss account. Types of cost, Depreciation & methods of calculating depreciation
7. **Entrepreneurship Development and Project Planning:**
   a) Entrepreneur as a dynamic agent of change. Special importance of entrepreneurship development in a developing country.
   b) Entrepreneurial characteristics : Development of entrepreneurial traits. Entrepreneurial motivation skills required by an entrepreneur.
   c) Need for efficient supports systems : Project formulation, infrastructure facilities, finance etc. Road map for setup of an industry.
   d) Preparation of project report : its stages - selection of product, project planning, investment decision, price-cost relationship, appraisal etc.
8. **Appraisals of a project**:
   Appraisal of project in terms of technical feasibility, commercial feasibility, financial feasibility and overall managerial feasibility.
9. **Labour Legislations :**
   The Indian Factories act , Indian Electricity rules , Industrial Disputes act , Workmen's compensations act , The Employee's State Insurance act .
10. **Industrial Policy of Govt. Of India & State Govt.**
11. **An overview of Tax – structure at National & State level**
12. **Disaster & Mind Management.**

BOOKS:-

[1] Industrial Engineering & Management by O. P. Khanna
[2] Industrial Organisation & Engineering by S.C. Sharma & T.R. Banga
[3] Entrepreneurial Development by S.S. Khanka

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 701 Electrical Machine Design – 1

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Prac t	Exam	Theory Paper	Theory Marks	Prac t	TW	Total
Electrical Machine Design-I	E-701	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. GENERAL ASPECTS
Insulating Materials & Classifications, heating of electrical machines **,** Cooling of Transformer and rotating machines **,** Electrical and Magnetic Loading , output coefficient , factor affecting size of machines , selection of B_{av} & ac **,** Duty cycle and equivalent ratings

2. DESIGN OF THREE PHASE TRANSFORMER
Types of transformers, position of HV and LV windings, core and yoke cross-sectional area, importance of mitered joints., Different types of transformers windings. Different methods for cooling of transformer, Different positions of tapings. Output equation for 3 phase transformers, window space factor, factors affecting window space factor. Relation between emf per turn and transformer rating, factors affecting constant K, stacking factor, examples. Selection of flux density and current density, Window dimensions, Yoke dimensions and overall core dimension calculations, examples. Design of HV and LV windings (No. of turns and area of cross section). Estimation of operating characteristics. Primary and secondary winding resistance. Leakage reactance calculation of only cylindrical coil with equal height, Leakage reactance of unequal windings and heights, only formula. No load current calculations for 3 phase transformers. Temperature rise of transformer, design of tank with tubes, calculation of dimension of tank, examples. Optimum design Design for minimum cost. Design for minimum loss. Variation of output and losses in transformer with linear dimensions. Dry transformer, high frequency transformer, solid R- core transformer. Algorithm and flowchart. Design considerations for surges. costing

3. DC MACHINE DESIGN
Introduction, output equation, mmf calculation Selection of Number of poles, core length, armature diameter,Carter's fringing curves, length of air gap, examples on above topics costing
ARMATURE DESIGN
Choice of armature winding, armature conductor, number of armature slots, slot dimensions, slot loading, design of armature core, Problems on above topics, costing
DESIGN OF FIELD SYSTEMS
Pole design, design of field winding of shunt, series and compound machines, examples Design of interpole, effects and minimization armature reaction Design of commutator and brushes, Improvement in commutation Performance calculation Algorithm and flowchart for CAD Design consideration for large machines, HV machines and miniature DC motors costing

4, DESIGN OF CURRENT TRANSORMERS
Introduction, construction Design principles, core design Secondary current rating, primary current rating and winding design Behavior of transformer, under normal and abnormal condition, turn compensation Design of Potential transformer costing

TERM WORK
Design of three phase transformer
Drawing sheet of three phase transformer
Design of DC machines
Drawing Sheet of DC machine components.
Tutorial on General aspects and C.T. , P.T.
BOOKS
A course in electrical machine Design – A. K. Sawhney
Electrical Machine Design – R. K. Agrawal

Design of Electrical Machine- V. N. Mittle

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E - 702 Interconnected Power System

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Interconnected Power System	E-702	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. LOAD FLOW STUDY
-Introduction – Bus Classification, Network. Model Formulation, Nodal Admittance Matrix Load Flow Problems – Gauss Siedel Method, N – R Method, Decoupled Load Flow Study, Comparison Load Flow Methods

2. ECONOMIC LOAD DISPATCH
-Introduction – Optimal Operation Of Generators connected to a busbar , Economic Dispatch Neglecting Losses, Optimal Unit Commitment, Reliability Considerations – Optimal Generation Scheduling – Transmission Loss Formula

3. LOAD FREQUENCY CONTROL AND AVR CONTROL
-Introduction – Load Frequency Control Of Single Area System – Load Frequency Problem, Speed Governing System – Selective Frequency Control, Tie Line Frequency Control, Cascade Triping, Islanding System ,AVR control & it's methods.

4. POWER SYSTEM STABILITY
-Power Flow Dynamics Of Synchronous Machine – Power Angle Equation – Steady State And Transient Stability, Equal Area Criterion – Swing Equation And Numerical Solution, Factors Affecting Transient Stability – Automatic Voltage Regulator – Effects Of Grading On Stability – Multi Machine Stability – Classical Model – Limitation Of Classical Methods

5. POWER SYSTEM SECURITIES
-Introduction – System State Classification – Security Analysis – Contingency Analysis – Sensitivity Factors – SCOPE – Security Constrained Optimum Power Flow

TERM WORK

T.W. will be based on the above syllabus

BOOKS:

1. Modern Power System Analysis – Nagrath & Kothari
2. Power Generation, Operation And Control – Wood & Wooler Beng
3. Power System Analysis – John J. Grainger
4. Electrical Energy System Theory – Ole Elgerd
5. Power System Analysis – William D. Stevenson
6. Advance PSA & Dynamics – L. P. Singh
7. Power System Analysis – Wadhwa
8. Power System Analysis – Glover And Sharma
9. Power system Stability- Vol. I - Kimbark

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 703 Electrical Switchgears

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Prac t	Exam	Theory Paper	Theory Marks	Prac t	TW	Total
Electrical Switchgears	E-703	04	0	Sessional	1½ Hrs	50	0	0	150
				University	3 Hrs	100			

1. Introduction:

Fault clearing process, types of mechanism (manual, semiautomatic, automatic), electrical and mechanical Interlocks, indication and auxiliary switch.Auto reclosure, the transient phenomena during fault clearing process.

2. Fundamentals of fault clearing:

Sudden short circuit on R-L series circuit- current interruption in A.C. circuit breaker-transient recovery voltage- effect of natural frequency, power factor on TRV- effect of reactance drop on power frequency recovery voltage- effect of armature reaction on recovery voltage- effect of first pole to clear factor- single, double frequency transient- rate of rise of TRV-derivation of restriking voltage- examples on above topics- interruption of low magnetizing current, current chopping- use of Opening resistor- switching of capacitor bank, unloaded lines and unloaded cables- interruption of terminal fault and short line fault- phase opposition switching.

3. The arc extinction mechanism and characteristics of quenching medium:

The matter & plasma- Ionization of gases – Deionization- Arc formation in A.C. Circuit breaker-modes of arc extinction – high resistance interruption- low resistance of zero point extinction- arc interruption theory- arc extinction in different medium- arc time constant

4. Constants of circuit breaking:

In relation to circuit breaking-Circuit constants circuit breaking rating- circuit constants and circuit conditions restriking voltage- transient characteristics of restriking voltage- expression for RRRV- Factors affecting the restriking voltage characteristics, current chopping interruption of small inductive currents capacitor switching.

5. Circuit breaker types and theory:

Automatic switching- air break circuit breaker, oil circuit breakers, single and multi- break construction- performance of Circuit breakers- minimum oil circuit breakers, air-blast circuit breakers- SF6 circuit breakers, Vacuum circuit breakers- Moulded case circuit breakers- Their relative merits and demerits, applications, Interruption methods- voltage Distribution in oil circuit breakers with arc control devices- modification of circuit breaker duty by shunt resistors- auto
Reclosures and fuses.

6. Testing and development of circuit breaker:

High voltage testing- short circuit testing of circuit breaker- direct testing and indirect testing of circuit breakers, Modern trends- Vacuum circuit breakers, SF6 circuit breakers and D.C. circuit breakers- Synthetic testing of circuit breakers.

7. Low, medium and high voltage switchgears:

Metal clad switchgear, SF6 filled switchgear, control panels, load breaking switches, contactors, thyristorised switching of capacitor banks and reactors.

8. Testing and maintenance of protective gear:

Classification of testing-general method of testing protective gear current transformer test-potential transformer test

9. D.C. Circuit Breaker :

Why HVDC CB's are required- Different schemes for d.c. interruption- recent developments in this field- Using thyristor based techniques and using a metallic return transfer breaker- application of DCCB.

10. Environmental aspects :

Alternate source against sulphur hexaflouride SF_6 gas as insulating medium.

Books:-

Switchgear and protection – S.S. Rao.
Power system protection & switchgear – B. Ravindranath & M. Chander
Switchgear and protection – J.B. Gupta
JNP switchgear by R.T. Lithal

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 704 Power System Practice & Design

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Power System Practice and Design	E-704	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Transmission Line Design for any given rating
Electrical design of transmission line, Design philosophy, voltage level selection and choice of conductors, spacing of conductor and corona, insulators and SIL, design problem Mechanical design of transmission line Considerations, loading on conductors, span, sag and tension clearance, stringing, problems, Transmission line tower design Location of tower, earth wires, reduction of tower footing resistance, design of tower, examples EHV transmission line design Considerations, selection, spacing of conductors, corona and radio interference, shunt and series compensation, tuned power lines, insulation coordination and different types of EHV towers, EHV systems in India.

2. HVDC Transmission
Merits and demerits of HVDC transmission, one line diagram, types of DC link, necessary equipments, operation and control, applications, recent advances, HVDC in India

3. AC and DC Low Tension Distribution Design
Types of distribution systems arrangements, selection and size of feeders using Kelvin's law, design of cables in distribution systems considering ampere capacity, voltage drop during starting and running load, primary distribution design, secondary distribution design, HV distribution design concept, load balancing Distribution substation Calculation of distributor size and its examples, calculation of voltage drops and size of distributor in ring system Voltage regulation and lamp flicker

4. Design of Power System
Introduction, selection of sizes and location of generating stations, selection and specifications of transmission lines, sizes and locations of sub stations, interconnections

5. Power System Improvement, Substation Design (Cathodic Protection Including GIS)
Introduction, methods of power system improvement, power system improvement scheme, determination of voltage regulation and losses in power system, shifting of distribution transformer centre, financial aspects of the power system improvement scheme

6. Power System Earthing – Power Station and Sub Station Earthing
Objectives, definitions, tolerable limits of body currents, soil resistivity, measurement of soil resistivity, earth resistance, measurement of earth resistance, tolerable step and touch voltage, actual step and touch voltage, design of earthing grid, impulse behavior of earthing system

7. Insulation Coordination and Location Of Lightning Arrestor
Introduction, definitions, insulation-co-ordination curves, determination of line insulation, Basic Insulation level(BIL), Insulation levels of substation equipments, Lightning arrestor selection and location, Selection of arrestor voltage rating, arrestor discharge voltage and arrestor discharge current, protective margin.

Note : T.W. will be based on the above syllabus.

BOOKS:
Electrical Power System Design – M. V. Deshpande
Electrical Power System Design – B. R. Gupta
Electrical Power System Planning – A. S. Pabla
Substation Design – Satnam & Gupta
A course in Electrical Power- Soni,,Gupta and Bhatnagar.

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 705 A (Elective – 1) Microcontroller & PLC

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Prac t	Exam	Theory Paper	Theory Marks	Prac t	TW	Total
Elective I Microprocessor and PLC	E-705 A	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

A. 8051 – 8 Bit Microcontroller

1. Introduction to 8051 micro controllers and overview of 8051 family, Assembly programming, Program counter and ROM space, Data types and directives, Flag bits and PSW register, Register banks and stack.

2. Jump, loop and call instructions, Time delay generation and calculation, I/O port programming, Pin description of 8051, bit manipulation, 8051 addressing modes:

3. Arithmetic Instructions and Programs: Unsigned addition and subtraction, Unsigned multiplication and division, signed number concepts and arithmetic operations, Logic Instructions and Programs: Logic and compare instructions, Rotate and swap instructions, BCD and ASCII application programs, Single bit instructions and programming, single bit operation with carry, Reading input pins vs. port latch

4. Timer/ Counter and Interrupts programming: Programming 8051 timers, counter programming; Programming timer interrupts, external hardware interrupts and serial communication interrupt, Interrupt priority in 8051, 8051 Serial communication: Basics of serial communication, connection to RS232, serial communication programming.

5. 8051 Interfacing: 8051 interfacing to ADC, DAC, Sensors, LCD, Keyboard, 8255, Interfacing to external memory:

B. Programmable Logic Controller

1. An overview of PLC, General programming procedure, Input and Output module interfacing, Programming ON/OFF inputs to produce ON/OFF outputs, Relation of digital gate logic to contact / coil logic, Creating ladder diagrams from process control descriptions, Basics of register.

2. PLC Functions: Timer function, Counter function, Arithmetic function, Number comparison functions, Numbering systems and number conversion function, Skip and Master control relay functions, Jump functions, PLC data move systems and other PLC data handling function, Digital bit functions and applications, Sequencer function, PLC matrix functions

3. Analog PLC operations, **Applications of PLCs in Power system, Control of drives etc.**

Note: T.W. will be based on the above syllabus.

Books:

Microcontrollers Theory and Applications By Ajay V Deshmukh, TMH Publishing Co. Ltd.
The 8051 Microcontroller & Embedded Systems By Muhammad Ali Mazidi , Janice Gillispie Mazidi , Pearson Education Inc.
The 8051 Microcontroller, Architecture, Programming & Application By Kenneth J. Ayla, Penaram Publication.
Programmable Logic Controllers By John R. Hackworth, Frederick D. Hackworth, Pearson Education Inc.
Programmable Logic Controllers, Principles & Applications by john W. Webb, Ronald A. Reis, PHI
Programmable Logic Controllers & their Engineering Applications by A. J. Crispin, McGraw Hill.
Programmable Controllers by Thomas A Hughes, I S A.

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 705 B (Elective – 1) Advanced Power System

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Prac t	Exam	Theory Paper	Theory Marks	Prac t	TW	Total
Elective I Advanced Power System	E-705 B	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Theory of Steady State Reactive Power Control in Electric Transmission Systems / Load Compensation
Introduction – historical back ground, Fundamental requirement in A.C. Power Transmission, Engineering factors affecting stability and Voltage Control – Uncompensated and Compensated Lines – Types of Compensation Passive / Active Compensation – Examples based on above

2. Objectives of Load Compensation, Power Factor Correction and Voltage Regulation, Load Compensation in terms of Symmetrical Components

3. Introduction to FACTS and HVDC Technology
FACTS concept, transmission interconnections, flow of power in A.C. systems – loading capability – power flow and dynamic stability – relative importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS technology
HVDC transmission – comparison between AC – DC transmission – modeling of HVDC system – AC DC load flow – harmonics and other problems

4. Overview of Power Quality and Power Quality Standards, Power Quality, Voltage Quality, Overview of Power Quality Phenomenon, Power Quality And EMC Standards
Long Interruptions – Introduction to Interruptions – Causes of Long Interruptions – Observation of System Performance, Standard and Regulations, Short Interruptions – Introductions – Terminology – Origin Of Short Interruptions, Monitoring, Voltage Sags – Harmonics – Introduction – Harmonic Sources – Effects Of Harmonics On Electrical Equipments – resonance – shunt capacitors – filter systems

5. Power System Dynamics
Dynamics of synchronous generators – analysis of single machine system – power system stabilizer

6. Voltage Stability
Introductions – definitions – reactive power transmission – comparison of rotor angle stability and voltage stability – surge impedance loading – voltage stability limit and analysis – graphical methods voltage collapse – prevention of voltage collapse – future trends and challenges

7. Short Circuit Studies Using Z – Bus and Y – Bus
Introduction – types of faults – short circuit studies of a large power system networks – algorithms for calculating system conditions after the fault occurrence – direct short circuit bolted faults – comparison between symmetrical components and phase co ordinate method of short circuit study using Y- bus

Note: T.W.and Practicals will be based on the above syllabus.
BOOKS:
Reactive Power Compensation – T. J. E. Miller
Understanding FACTS – N. G. Hingorani
HVDC – K. R. Padhiyar
Understanding Power Quality Problems – H. J. Boller (IEEE press)
Computer Techniques in power system- M.A.Pai
Modern Power system analysis and design- B.R.Gupta
Modern Power system analysis- Nagrath Kothari

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 705 C (Elective – 1) Advanced Power Electronics – 1

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elective-I Advanced Power Electronics-I	E-705 C	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Resonant Converters :**
   Introduction, Classification, Series resonant, Parallel resonant inverter, Class E resonant inverter/rectifier, Zero current / Zero voltage resonant converter, Comparison between ZCS and ZVS, Two quadrant ZVS converter, Resonant dc link inverters, Inverters for UPS.
2. **Multi level and multi pulse converters :**
   Introduction, Types of multi level converters, Types of multi pulse converters, Different transformer connections for multi pulse inverter, Applications of multi level and multi pulse converters.
3. **PWM Techniques :**
   SPWM, EPWM, Trapezoidal, Staircase, Stepped, Harmonic injected, Harmony reduction techniques.
4. **Modelling of Power Electronics Circuits :**
   Mathematical modeling of converters, Modeling of power electronics circuits in term of transfer function, Design of magnetic components (Ferrite core, High frequency winding), Inductor design.
5. **Heat Sink Calculation & Cooling of Power Semiconductor Devices :**
   Heat transfer consideration, Thermal resistance of heat sink. Types of heat sinks, Effect of overload and pulse loading, Mounting techniques.
6. **Gate Circuit Design :**
   IGBT, MOSFET, Gate triggering Circuits, Electrically isolated drive circuits, DC coupled drive circuits.
7. **Power Electronics Building Block :**
   Introduction, Block diagram of different PEBB, Applications in Marine Engineering.
8. **Custom Power :**
   Introduction, Concept, Application with case study.
9. **Intelligent Power Modules :**
   Introduction, Functional integration, Levels of integration.

Note: T.W. will be based on the above syllabus.

Books:

Power Electronics Circuits, Devices and Applications by M H Rashid.
Power Electronics Converters Applications and Design by Ned Mohan.
Modern Power Electronics by B K Bose.
Control of Drives by Krishnan.

Application Notes :

- International Rectifier
- Motorola Semiconductor
- NASA
- Naval Corporation of USA

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 705 D (Elective – 1) Energy Management

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elective-I Energy Management	E-705 D	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Energy Scenario:** Introduction to energy science and energy technology, various forms of energy, Law of conservation of energy, Usage Patterns of Energy in India, energy calculation and demand. Age of renewable and alternatives.National energy plan and energy strategy, energy management, energy conservation act-2001 and its features, energy sector reforms. Energy scenario of India ,Nodal agencies like BEE, GEDA,MNES, CEA, WEB etc.
2. **Energy management:** Concept of energy management, elements of energy management, energy cost, energy performance, energy saving calculations, balancing energy use and requirement, maximizing system efficiencies, optimizing input energy requirement, Demand Side Management
3. **Planning energy:** Need of energy planning, steps for energy planning, Role of energy manager, benchmarking, force field analysis
4. **Energy Transportation & Storage :** Energy transportation: bulk transportation of fuels- characteristics of transportation systems for solid liquid and gaseous fuels; coal liquification and gasification, safety measures; Energy Transportation Efficiency Problem of Electric Energy Transmission: Characteristics of short and long AC transmission lines; HVDC transmission, economic considerations. Energy storage: Demand for energy storage – stationary and transport applications; Integrated energy systems. Energy storage systems: heat storage- hot water, hot solids, phase change materials; Chemical storage – synthetic fuels, hydrogen, electrochemical. Mechanical, Potential energy storage: spring, compressed gas, pumped hydro; Flywheels, Rolling mills, Electrical and magnetic energy storage systems;
5. **Quality and Reliability of Industrial / Commercial Power Systems:** Introduction, Harmonics in supply system, Voltage Sag, Power Factor Reliability analysis of power system
6. **Energy flow networks:** Simulation and modeling, formulation and objective and constraints, alternative option, Sankey Diagram
7. **Economic aspects of energy audit:** Cost evaluation by ROI, IRR Cost evaluation by payback terms. Organization for energy management. Conservation measures and diagnostic review
8. **Energy Audit & Case Studies:** Introduction, types and walkthrough energy audit. Energy audit at unit level, Industrial Audit approaches. Procedure for energy audit and equipments required. Comprehensive Energy audit Site testing Measurement & Analysis of Electrical System like Induction Motors, Transformers, synchronous Machines, Illumination system, Domestic Appliances Site testing Measurement & Analysis of Electrical System like Boilers, Furnaces, Refrigeration and Airconditioning System

Note: T.W. will be based on the above syllabus.
Books:
A Guide to Energy Management by Barney L Capehart, William J Kennedy, Wayne C Turner
Energy Technology by S. Rao
Energy conservation techniques by P.M. Dave & M.N.sheth
Non Conventional Energy Sources by G D Rai
Course Material for Accredited Energy Managers & Energy Auditors – Bureau of Energy Efficiency
website www.energymanagertraining.com, www.bee-india.gov.in

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E – 705 E (Elective-I) NANOTECHNOLOGY –I

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elective-I Nanotechnology-I	E-705 E	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Introduction**.
   Fundamental issues of nanotechnology
   Comparision of Micro & Nano technology
   Small devices tools
   Molecular construction
2. **Nano Structures**
   Introduction
   Metal Nanoclusters, Semiconductor nanoparticles.
3. **Organic compounds and Polymers**
   Introduction
   Forming & characterizing polymers, Nanocrystals, polymers, supermolecular structures.
4. **Nanotechnology Building Tools**
   Atomic force microscope
   Scanning electron microscope
   Transmission electron microscope
   Magnetic resonance force microscope
5. **Nanotubes, Nanowires & Nanofibers**
   Introduction
   Production technology at Atomic level
6. **Building Issues**
   Dissipating static electricity
   FETs and SETs
   Lithograpy methods
   Fabrication process : Introduction
   Memory fabrication process
7. **Photo optics in Nanotechnology**
   Introduction
   Optical switching
   Photonic band gaps.

Note: T.W. will be based on the above syllabus.

Books:-

1. Nanotechnology :- by Richard Booker, Earl Boysen
2. Introduction to Nanotechnology :- by Charles P. Poole, Frank J. Owens.

GUJARAT UNIVERSITY
B. E. SEM VII (ELECTRICAL ENGINEERING)

E- 706 Project

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Project	E-706	0	02	Sessional	---	0	25	25	50
				University	---	0			

The objectives of the course are :

- To provide students with a comprehensive experience of applying the knowledge gained so far.
- To develop aptitude, build confidence, communication skill and presentation abilities amongst the fraternity in which he / she belongs.
- To provide an opportunity to do something creative in real life work situation.
- To advance institute – industry interaction / relationship.

A student is required to carry out project work related to Electrical Engineering. Under supervision / guidance of staff members, the project may be based on either design and/or fabrication or simulation on computer or society/industry need based survey or testing etc. Project work can be carried out in the Institute or in the Industry or in any research organization. The student can undertake project singly or in a batch, of not more than five students.

At the end of the semester, student will be required to submit a report consist of aim & objective, literature survey, work done, and conclusion derived if any with further scope of studies and will defend before the examiners at the time of final evaluation.

GUJARAT UNIVERSITY
B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 801 Commissioning of Electrical Equipment

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Commissioning of Electrical Equipment	E-801	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

Transformer

Testing procedure for HV testing ,Phase shifting/ phase group , Radio interference, Ratio Test , Load loss ,Separate source voltage testing ,Induced voltage testing , Impulse & Surge testing , Noise level & vibration testing , Short circuit withstand test ,Tan Delta test , Core insulation voltage test , Measurement of impedance ,Testing of auxiliaries & safety device , Oil testing , Classification of testing methods , Testing of bushing. DC & AC Resistance measurement ,Temp. rise test , Short circuit test , Dielectric test , Partial discharge , Insulation resistance testing . Polarity testing , Short time current rating , Impulse & surge testing, Determination of error & accuracy class , Power frequency voltage withstand test ,Over voltage inter-turn test .

Determination of polarization index for transformer.
Drying out procedure for transformer.
Commissioning steps for transformer
Purification & Filtration Procedure for Transformer oil.
Troubleshooting & Maintenance of transformer.

Induction Motor

Testing (3-phase & 1-phase)
Hammer test , Testing against variation of voltage/current/frequency, Load test, NL & BR test , DC & AC Resistance measurement , Insulation measurement , Starting test , Temp. rise test , Slip measurement , HV test ,Testing on auxiliaries , Vibration Test , Noise level test.

Drying out methods / Polarization Index / Hot Temperature measurement
Degree of protection (IP Grade)
Commissioning steps for Induction motor, Heat Run Test.
Commissioning of Induction Generator.
Troubleshooting & maintenance of induction motor

Sub station equipments

Bus bar
Temp. Rise test, Rated short time current test, HV test, Power frequency voltage withstand test, Impulse / surge testing, Vibration.
Earthing
Earthing resistance measurement, Substation grid Earthing, Soil resistivity measurement.
Isolator Testing
Temp. Resistance test, Short circuit test, Charging current making & breaking test, Inductive current making & breaking test.
Circuit breaker
Testing of HV/LV circuit breaker
No load Mechanical Operation , Mechanical endurance test , Temp. rise test ,Impulse & surge testing , short time current test . Short circuit making & breaking test , Line Charging current making & breaking test ,Cable charging & capacitor bank making & breaking test ,Out of phase switching ,Short line fault test ,Electrical & Mechanical endurance test for LT switch gear like MCB/ MCCB/ ELCB etc.

C.T. & P.T. Testing , Relay testing , Coupling capacitors, Station Batteries for D.C. Supply , Fire Shifting Equipments. Testing & Commissioning of Lightning Arrestor, Substation Commissioning by Thermography.
Troubleshooting & maintenance of circuit breakers.

DC Machine

Testing
Voltage drop test or bar to bar test , Load test , Open circuit & magnetizing test ,Insulation resistance , Starting performance, Dielectric test. Swinburn's test, Hopkinson's test, Field test, Separation of losses in DC shunt machine. Temp. rise test & Heat run test
Drying out process
Commissioning steps for DC machines
Troubleshooting & maintenance

Synchronous machine

Testing
OC & SC test ,Characteristics , Loss measurement, Temp. rise test , Over speed test , HV testing , Insulation resistance wave form interference , DC & AC Resistance of armature & field winding measurement , Dielectric testing on armature & field winding , Mechanical balance , Magnetic balance , Current balance , Phase sequence , Harmonic analysis , reactance & time constant , Speed torque current , Vibration & noise measurement , SC test , Synchronizing circuit testing , Testing of voltage regulators , Excitation circuit testing ,Voltage recovery test , Retardation test on load / no load .
Drying out procedure
Commissioning steps for synchronous machines
Troubleshooting & maintenance

Commissioning of transmission line & Cable .
Derating of cable capacity , HV test , AC & DC Resistance check , Insulation resistance , Impedance measurement , Location finding technique for fault in under ground cables (Murray loop test & Warley loop test) , Testing of open circuit faults in cables . Line charging, loading & Dropping.

Disaster management - Post disaster commissioning of power system component
e. g. generator,transmission line, Electrical machines and equipments.

Term work
Term work shall be based on above syllabus.

Reference book

[1] Testing, Commissioning & maintenance of electrical equipment
By S. S. Rao
[2] The commissioning of Electrical Plant
By RCH Richardson (Chapman & Hall)

GUJARAT UNIVERSITY
B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 802 Power System Protection

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Power System Protection	E-802	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Introduction:
Requirements of protective systems- primary and auxiliary protection, types of backup, essential requirements of protective systems basic terminology- method of discrimination, instrument transformer.

2. Different relays, its characteristics and application
Operating principles and constructional features of electromagnetic relays- classification of relays, principle, types of electromagnetic relays- theory of induction relay torque- various types of induction relays- general equations of electromagnetic relays, over current relays, instantaneous over current relay, plug setting and time multiplying setting in induction disc relays- directional relays, differential relays, distances relays etc. applications.

3. Carrier aided protection of transmission lines
Need for carrier aided protection of transmission lines- various option for carrier. Coupling and trapping the carrier into the desired line section, single line to ground coupling, line to line coupling, unit type carrier aided directional comparison relaying, carrier aided distance scheme for acceleration of zone II, transfer trip or inter trip, permissive inter trip, acceleration of zone II, preacceleration of zone II, phase comparison relaying (unit scheme)

4. Apparatus protection scheme:
Generator protection, transformer protection, Gas operated relay, over current, earth fault, restricted earth fault protection, differential protection, other problems and their remedies, overall generator, transformer protection, protection of small motors, protection of large motor against overload, short circuit, unbalanced loading, earth fault & under voltage comprehensive motor protection relay- feeder and bus zone protection

5. Numerical protection
Introduction- block diagram of numerical relay, sampling theorem, correlation with reference wave, Fourier analysis of analog signals, least error squared (LE) technique, digital filtering, simple low pass filter, simple high pass filter, finite impulse response filters, infinite impulse filters, comparison between FIR & IIR filters- block diagram in details for few relays

6. Relay testing methods and equipments
Installation and commissioning tests – special tests – overshoot tests, accuracy tests, range tests and stability tests – test procedure – current injection jet – programmable testing equipments

Note: T.W.and Practicals will be based on the above syllabus.

Books:-
Fundamentals Of Power System Protection – Y. G. Parithankar & S. R. Bhide
Switchgear And Protection – S. S. Rao
Art And Science Of Protective Relaying – Masson
Power System Protection And Switchgear – B. Ravindranath And M. Chander
Power System Protection – B. Ram
Power System Protection – Patra, Basu , Chaudhar

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B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 803 Electrical Machine Design II

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Machine Design-II	E-803	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1 Induction motor design

Output equation , choice of specific scheme, separation of D & L, peripheral

Stator winding design, Calculation of no. of turns per phase, conductor's area shape of the stator slots, factors to be considered while deciding no of stator slots, Area of stator slots, stator winding resistance, stator teeth design, depth of the stator core, examples related to above topics

Length of the air gap

Rotor design A. Squirrel cage rotor – selection of no. of rotor slots, harmonic induction torque. Harmonic synchronous torque, vibration and noise, voltage ripples, rules for selecting no. of rotor slots, Methods for reducing harmonic torque, design of rotor bars and slots, calculation of rotor bar current, area of rotor bars, shape of rotor slots, examples, Design of end rings, Calculation of end rings current, cross sectional area of end rings

B. Design of wound rotor - calculation of number of rotor slots, no. of turns, cross sectional area of rotor conductors, types of rotor windings, check for rotor tooth density, design of rotor core, examples

Estimation of operating characteristics- no load current calculation, short circuit current calculation, stator and rotor resistance and reactance calculation, examples, circle diagram, Dispersion coefficient – effect on maximum output power factor

Performance calculation, costing

Design aspects for large size machine, high voltage m/c, High speed m/c, algorithm and flow chart

Design of submersible motors ,costing

2 Design of single phase induction motor

Types of motors, Design of main dimensions, design of stator, Design of rotor, calculation of operating characteristic(rotor resistance, stator resistance, iron loss, friction and windage loss etc, Design of auxillary winding, starting torque, circle diagram, design of capacitance for maximum torque, costing

3 Synchronous machine design

Introduction, output equations, Main dimension, SCR, effect of SCR on machine performance

Length of air gap and shape of pole face

Armature design, Armature winding (Single layer and double layer), number of armature slots, slots dimension, length of mean turns, calculation of armature resistance and reactance

Design of rotor , Design of magnetic circuit, Open circuit characteristic

Determination of full load field MMF, Design of field winding

Determination of direct and Quadrature axis synchronous reactance.

Short circuit characteristics, Performance evaluation

Design of Turbo alternators, Main dimension, Length of air gap, Stator & Rotor design

Algorithms and Flow chart

Design consideration for low speed alternators and vertically operated alternator,

costing

Term work :

1. Design of 3 phase I.M
2. Drawing sheet of 3 phase I.M with circle dia
3. Drawing and description of syn. M/c components
4. Design of syn. m/c
5. Tutorials of single phase I.M and Submersible pumps

Books:

1. A Course in electrical machine design – A. K. Sawhey
2. Electrical machine design – R. K. Agrawal

3. Design of Electrical machines – V. N. Mittle

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B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 804 Electrical Power Utilization & Traction

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Electrical Power Utilization & Traction	E-804	04	0	Sessional	1½ Hrs	50	0	0	150
				University	3 Hrs	100			

1. ELECTRIC DRIVES:

Introduction concept of electric drives, classification of electric drives, nature of load, factors effecting selection of drive, Running characteristics of D.C, Series and shunt motor, 3-phase induction motor,3-phase synchronous motor and A.C series motors,Starting methods of D.C series and shunt motors, starting methods of 3-phase induction motors, examples, starting methods of synchronous motors and single-phase induction motor. Speed control of D.C series and shunt motors, examples. Speed control of 3-phase induction motor. Examples, Methods of electric braking, of D.C motor, examples. Braking of 3-phase induction motor, Mechanical features of electric drive, Load equalization, flywheel calculations, examples. Temperatures rise of electric drives beating and cooling curves, standard ratings of motors, examples Applications of electric drives and selection of drives for particular service, conservation approach to be considered. Energy efficient drives.

2. ELECTRICAL TRACTION:

Introductions, different traction systems, various systems of electric traction. Locomotives, tramways, trolleys, track electrification, comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, examples. Mechanics of train movement, tractive effort, power, output, examples., Energy output from driving axles, energy output using simplified speed-time curves, examples, Factors affecting energy consumption, dead weight, accelerating weight, abhesion weight, examples., Traction motors and their characteristics, starting and speed control of D.C series and shunt motors, examples, Starting and speed control of A.C series and 3-phase induction motors, Braking of traction motors and mechanical considerations, conservation approach to be considered.

3. ELECTRICAL HEATING & WELDING

Advantages of electric heating, modes of transfer of heat, classification of electric heating methods, Resistances heating methods, requirements of heating elements, design of heating elements, methods of temperature control, problems, Induction heating: principle, types of induction furnaces, direct core type, vertical core type, indirect core type, core less type, advantages and disadvantages, eddy current heating, applications examples., Arc-furnace: principle, types, direct and indirect arc furnaces, power supply and control, condition for maximum output, examples., Dielectric heating: principles, advantages and disadvantages, applications, choice of frequency, examples., Electric welding: different types of resistance welding and electric arc welding, conservation approach to be considered. Energy efficient processes.

4. ELECTROLYTIC PROCESS:

Principle, Faradays laws of electrolysis, current efficiency, energy efficiency etc., Rating of metals, production of chemicals, Electro-deposition, electroplating, power supply for electrolytic processes.

5. ILLUMINATIONS:

Nature of light, definitions, laws of illumination, different types of lamps, tungsten lamp, discharge lamp, sodium vapour lamp, fluorescent lamp, design of lighting scheme, methods of lighting, calculations, examples., flood lighting, factory lighting and street lighting, examples., conservation approach to be considered.

Books:-

Electrical Power Utilization – Taylor.
Electrical Power Utilization – J. B. Gupta.
Electric Traction – H. Partab.
Electrical Power Utilization – B.L. Theraja.
A text book on Power System Engg. – Soni, Gupta, Bhatnagar,

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B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 805 A (Elective II) Digital Signal Processing in Electrical Engineering

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
ElectiveII Digital Signal Processing in Electrical Engineering	E-805 A	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

A. Digital Signal Processing:

1. **Discrete Time Signals & Systems:** Introduction, Discrete time signals, Discrete time systems, LTI system, Properties of LTI systems, Constant coefficient differential equations, Frequency domain representation of discrete time systems and signals, Representation of sequences by Fourier transform, Properties of Fourier transform, Fourier transform theorems, Discrete time random signals.
2. **Z Transform:** Properties of Z transform, Z transform and Inverse Z transform
3. **Sampling of Continuous time Signals:** Periodic sampling, Frequency domain representative of sampling, Reconstructions of band limited signals from its samples
4. **Structures for Discrete Time Systems:** Block diagram representation of linear constant coefficient differential equations, Signal flow graph representation, Basic structures of IIR systems, Transposed forms, Basic structures for FIR systems.

B. Digital Signal Processor:

5. **Introduction to TMSLF2407 DSP Controller:** Introduction, Brief Introduction to Peripherals, Types of Physical Memory and Introduction to Software tools (for Practical Work).
6. **C2xx DSP CPU and Instruction Set:** Introduction to the C2xx DSP core and code generation, The component of C2xx DSP Core, Mapping external devices to the C2xx core and the peripheral interface, Intorduction to system configuration register, Memory, Memory addressing modes, Assembly programming using C2xx DSP Instruction Set.
7. **General Purpose I/O:** Functionality, Pin multiplexing and general purpose I/O overview, Introduction to Multiplexing and general purpose I/O Control registers, General purpose I/O ports
8. **Interrupts on the TMS320LF2407:** Introduction to interrupts, Interrupts hierarchy, Interrupt control registers.
9. **The Analog to Digital Converter:** ADC Overview, Operation of the ADC, Sequence configuration of ADC, Sequencer operating mode, Triggering source for the LF2407 ADC, Introduction to ADC control registers.
10. **The Event Managers:** Overview of event manager, Event manager interrupts – Introduction to Interrupt Flag registers, General purpose Timers – GP timer inputs and outputs, GP counting operation, Introduction to control register associated with GP timer, GP timer interrupts, PWM output and GP timer compare operation, Compare unit, Input and output of the compare unit, Operation of compare unit, Dead band generation, Register set up for compare unit, Compare unit interrupts, Introduction to Data memory mapped registers associated with compare units, Capture units and Quadrature encoded pulse (QEP) – Operation of capture unit, Capture Stack interrupt flag operation, QEP circuitry, Introduction to capture unit/QEP control register.
11. Comparison architecture of LF 2407 and LF 2812 processors. **Applications** of **TMS 320 LF 2407 :** Power Factor correction Converter, Motor Speed Measurement, Electromagnetic Interference (EMI), Applications of **TMS 320 LF 2812 :** Signal Conditioning of an LVDT, Solar Power Inverters, PWM output as a Digital to Analog Converter, Power Line Communications for Lighting Applications using BPSK.

C. Peripheral Interface Controller (PIC):

PIC microcontroller overview and features, PIC 16x ALU, CPU registers, pin diagram, pic reset action, PIC oscillator connection, PIC memory organization, OPTION register, INTCON register, PIC 16x instructions, Inputs and outputs, Addressing modes, I/O ports, Interrupts, timers, capture, compare and PWM modules in PIC 16F877, Introduction to serial peripheral interface (SPI) and **I^2C Bus**.

Note: T.W. will be based on the above syllabus.

Reference Books:

Digital Signal Processing By S. Salivahanan, A. Vallavaraj, C. Gnanapriya, TMH Publishing Co. Ltd.
Digital Signal Processing By Sanjit K. Mitra, TMH Publishing Co. Ltd.
DSP Based Electromechanical Motion Control by Hamid A Toliyat, Steven Campbell, CRC publication
Microcontrollers Theory and Applications By Ajay V Deshmukh, TMH Publishing Co. Ltd.
Design with PIC Microcontrollers By John B. Peatman, Pearson Education Inc.
DSP by Proakis & Manolakis, Pearson Education
DSP by S. Srinivasan
Digital Signal Processors by B. C. Kuo

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B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 805 B (Elective – ll) Power System operation and Control

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elective II Power System Operation & Control	E-805 B	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. Estimation of power system
Introduction – least squares estimation – steady state estimation of power systems – tracking state estimation of power systems – some computational considerations – external system equivalencing treatment of bad data – network observability – psendo measurements – applications of power system state estimations

2. Compensation in Power Systems
Introduction – loading capacity – load compensation – line compensation – STATCOM and SVC, UPEC, SSCC, PAC

3. Load Forecasting Techniques
Introduction – forecasting methodology – estimation of average and trend terms – estimation of periodic components – estimation of Y (k) – time series approach – kalman's filtering approach – economic models – reactive load forecast

4. Load dispatch centre
Activities of load dispatch

5. Reliability of Power System
Definition of reliability – outage – bath tub curve – two state model – failure and repair rate – probability density function – probability of survive and failure mean down time – continuous mark or process – reliability of series and parallel process – two state fluctuating environment mark or application – approximate method reliability planning – preparation of reliability methods

6. Optimal Power Flow, Generation Scheduling – Hydro Thermal Co Ordination – Unit Commitments

7. Distribution Automation
Distribution automation – project planning – definitions – communication – protocols – sensors – supervisory control and data acquisition – geographical information systems – automation systems

8. Market Restructuring
Basic power system economics and management – basic pricing principles- supply and demand side option – electricity pricing and market – load management and spot pricing – demand side management

Note: T.W. will be based on the above syllabus.

BOOKS

Modern Power System Analysis – Nagrath & Kothari
Modern Power System Planning – X – Wang
Electrical Power Distribution System – A. S. Pabla
Electric Power System – Weedy
Power system analysis and design- B.R. Gupta

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B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 805 C (Elective –II) Advanced Power Electronics – II

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elective II Advanced Power Electronics-II	E-805 C	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Brush less Drives DC and AC :**
   Introduction, Machine back ground, Electronic Commutation, Current Control, Torque Control, Switching Circuits, Applications, Switched reluctance motor drive.

2. **Synchronous Motor Drive :**
   Introduction, Performance with voltage source inverter, Current Source Inverter, Closed loop control of synchronous motor.

3. **Power Electronics Applications to Industry :**
   Induction heating, Electric welding, Power factor correction, Interconnection of renewable energy sources.

4. **Power Electronics Applications to Power System :**
   HVDC Transmission : Introduction, Components, Analysis of converter bridges, Different topologies.

5. **FACTS :**
   Steady state and dynamic problems in AC systems, Flexible AC transmission system (FACTS), Principles of series and shunt compensation, Description of static var compensators (SVC), Thyristor controlled series compensators (TCSC), Static phase shifters (SPS), Static condenser (STATCON), Static synchronous series compensators (SSSC), and Unified power flow controllers(UPFC) .

6. **Power Quality :**
   Introduction, Need of quality power, Issues releated to voltage, Harmonics, Active harmonic filters, Series, Shunt, Hybrid, Sources of harmonics (voltage and current source, type, non linear load) Different methods to mitigate the power quality problems.

Note: T.W. will be based on the above syllabus.

Books :

Modern Power Electronics and Drives by B K Bose.
Power Electronics Circuits, Devices and Applications (3rd Edition) PHI by M H Rashid.
Power Electronics Converters, Application, Design by Ned Mohan.
Static Reactive Power Compensation (John Wiley) by T J E Miller.
Fundamentals of FACTS by N. G. Hingorani.
HVDC Transmission by K. R. Padiar.
Power Quality by Ballen.

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B. E. SEM VIII (ELECTRICAL ENGINEERING)

E- 805 D (Elective – ll) Energy Efficiency in Utilities

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elective II Energy Efficiency in Utilities	E-805 D	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **The Electric Utility in Industry**
   Introduction
   Electric utilities characterized by function, Different regulated electric utility frameworks, "Electric Utility" structure in deregulated industry, Energy conservation task in industry, Co – generation
   Energy conservation in cement, textile, sugar, etc. industry
   Energy conservation in building.
2. **Energy performance assessment of motors / variable speed drives**
   Introduction, Efficiency of the induction motor
   Determining motor loading
   Field tests for determining efficiency
   Performance evaluation of rewound motors, Format for data collection
   Concept of variable frequency drives and Applications
   Factors for successful implementation of variable speed drives
   Information needed to evaluate energy savings for variable speed application
3. **Energy performance assessment of Pumps, Compressors, Blowers and Cooling Towers**
   Introduction and types
   Performance terms and definitions
   Performance Analysis and suggestions
4. **Modern Energy efficient technologies**
   Maximum demand controller
   Automatic power factor controller
   Energy efficient motors
   Soft starters with energy saver
   Energy efficient transformers, electronic ballast, occupancy sensors etc.
   Energy efficient lightning controls
   Energy saving in transportation system especially electric vehicle.
   Energy saving in air conditioning system

Reference

A Guide to Energy Management by Barney L Capehart, William J Kennedy, Wayne C Turner
Energy Technology by S. Rao
Energy conservation techniques by P.M. Dave & M.N.sheth
Course Material for Accredited Energy Managers & Energy Auditors – Bureau of Energy Efficiency
website : www.energymanagertraining.com, www.bee-india.gov.in

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E- 805 E (Elective – ll) NANOTECHNOLY – II

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Elective-II Nanotechnology –II	E-805 E	04	02	Sessional	1½ Hrs	50	25	25	200
				University	3 Hrs	100			

1. **Devising and Synthesis of NEMS and MEMS**.
   Classification.
   Microaccelerometer
   Modelling, Analysis and Simulation of NEMS / MEMS
   MATLAB Simulation.
2. **Micro machines**
   Introduction and Analogy
   Induction micromotor
   Synchro micro machine
   Mathematical modeling.
3. **Sensors and Transducers**
   Types, qyartz sensors
   Ultrasonic sensors
   Optical sensors
   Solid State micro sensors
   Piezo transmitters
   Working principle, selection criteria and Application.
4. **Biomedical Sensors and Application**
   Introduction
   Classifications
   Types.
5. **Nanotechnology Instruments**
   Block diagram
   Operation
   Applications
   AFM (Automic Force Microscope)
   TEM (Tunneling Electron Microscope)
   STM (Scanning Tunneling Microscope).

Note: T.W. will be based on the above syllabus.

Books :- 1. Nano and Micro electromechanical systems :- by S.E. Lyshevski
2. Nanotechnology :- by Richard booker Earl Boysen
3. Nanotechnology :- by Dr. Parag Diwan, Ashish Bhardwaj.
4. Instru. To Nanotechnology :- by Julian w. Gardner & Harry F.Hingle.

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E- 806 Project

Subject	Code	Teaching Scheme		Examination Scheme					
		Theory	Lab/ Pract	Exam	Theory Paper	Theory Marks	Pract	TW	Total
Project	E-806	0	02	Sessional	---	0	25	25	50
				University	---	0			

The objectives of the course are:

- To provide students with a comprehensive experience of applying the knowledge gained so far.
- To develop aptitude, build confidence, communication skill and presentation abilities amongst the fraternity in which he / she belongs.
- To provide an opportunity to do something creative in real life work situation.
- To advance institute – industry interaction / relationship.

A student is required to carry out project work related to Electrical Engineering. Under supervision / guidance of staff members, the project may be based on either design and/or fabrication or simulation on computer or society/industry need based survey or testing etc. Project work can be carried out in the Institute or in the Industry or in any research organization. The student can undertake project singly or in a batch, of not more than five students.

At the end of the semester, student will be required to submit a report consist of aim & objective, literature survey, work done, and conclusion derived if any with further scope of studies and will defend before the examiners at the time of final evaluation.