Bhavnagar University
B. E. Semester VIII (Electrical)
E- 801 Interconnected Power System

Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory		Practical marks	T/W marks	TOTAL	
			Hrs.	Max Marks	50	25	175	
3	2	0	3	100				

1. General system modeling-per unit system- power transfer through transmission - universal circle diagram - MVAR control-voltage control methods.

2. Load flow study : Introduction-Network model formulation- formation of bus admittance matrix-load flow problem-approximate load flow solution - Shipley inversion method - Gauss sidle method - Newton Raphson method - comparison.

3. Economic operation of power system : Economic operation of generators within the plant-transmission losses as function of plant generation. Economic distribution of load between plants co-coordinating transmission losses - Kron's method of evaluating loss co-efficient–penalty factor-Algorithm of different schemes.- Automatic load dispatching.

4. Load frequency control : Introduction - Single area control of frequency-modeling of turbine governor,turbine & generator steady state analysis-principle of frequency control -flat frequency, selective, tie line control methods.

5. Power system stability : Stability problem-classification -power angle characteristic-steady state & transient state stability & their limits.Dynamics of synchronous machines & swing equation-synchronizing power co-efficient-equal area criterion of stability & its application -critical clearing time & angle - numerical solution.

Visit : Students are required to visit LDC for power control study.

Reference books :

(1) Modern power system analysis - Nagarth & Kothari (Tata Mcgraw Hill)
(2) Power System Analysis - Stevenson (Mcgraw Hill)
(3) Electrical Power System - C.L. Wadhva (Wiley Eastern)

B. E. Semester VIII (Electrical)
E- 802 Electrical Machine Design

Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory		Practical marks	T/W marks	TOTAL	
			Hrs.	Max Marks	50	25	175	
4	2	0	3	100				

1. General Aspects:Insulating materials & classification-Heating of electrical machines-cooling of transformers & rotating machines - electrical & Magnetic loading - output co -efficient - factors affecting size of machines -

2. Transformer design:Output equation-optimum design considerations with a view to core loss, copper loss & weight of active materials-variation of output & losses with linear dimensions-design of core-selection of type of winding & its design - window space factor & dimensions-design of yoke & overall dimension-leakage reactance & resistance of winding-regulation-mechanical forces-No load current-change of parameters with frequency-temperature rise-design of cooling system.

3. Induction motor design : output equation - main dimensions - stator winding - stator slots...shape & area-stator core & teeth - LMT -rotor design - air gap length calculations selection of rotor slots - design of rotor bars & end ring -harmonic torques & reduction of harmonic torques – rotor winding design for would rotor - design of rotor teeth & core. Calculations of no load & short circuit - circle diagram - dispersion co-efficient -

4. Design D.C. machines:output equation - selection of number of poles,Core length & armature diameter - pole proportion & profile - length of air-gap. Armature design - choice of winding - no.of conductors & slots -slot dimensions - arm. voltage drop - design of arm. core.
Design of field system - design of interlope,commutater &brushes calculations of losses and efficiency.

5. Design of synchronous machines : output equation - main dimensions-short circuit ratio & its consideration-air gap length - shape of pole face - arm. design - armature winding – slots-LMT & stator core-calculation of arm. resistance & reactance - design of rotor-design of pole & pole winding - short circuit characteristic & performance evaluation -

Term work : At least design of 3 machines will be done by students & relevant design report as well as drawing sheets in full size will be submitted as term work.

Sketches of components & parts of designed machines will be drawing in sketch book & submitted as part of term work.

Books:(1) A course in electrical machine - A.K.Sawhney
(Dhanpatrai & Sons)
(2) Perf. & design of a.c. machines - M.G. Say (ELBS
(3) Performance & design of d.c. machines - Clayton (ELBS)

B. E. Semester VIII (Electrical)

E- 803 Electrical Commissioning ,Testing & Estimating

Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory		Practical marks	T/W marks	TOTAL	
			Hrs.	Max Marks	50	25	175	
4	2	0	3	100				

1. Commissioning of A.C. Motors : Insulation test, air gapes, bearings, perliminary run, starting torque & speed control, induction motor stator & rotor interaction balance & vibration, ventilation & colling, staters, syn. motors. A.C. motor troubles -insulation failure due to transient voltage-low starting torque - pull out & stalling torque - law pf - excessive slip crowli-single phasing - unbalanced operation of a.c. motors.

2. Commissioning of transformers : Insulation resistance & HV test of winding. condition of coil insulation & oil – drying out of transforemer-connection & phasing group-cooling & rating - temp. meas. & protection - parallel operation of transformers -correct pairing of transformer-transformer troubles.

3. Commissioning of D.C. generators : voltage build-up parallel operation-voltage regulation–commutation problem – miscellaneous troubles.

4. D.C.motors : factors affecting speed control, torque, breaking.

5. Preparation of alternator prior to putting in to commercial service : Preparation & drying out of alternator winding-insulation resistance measurements-HV test -measurement of temp. of winding -alt.protective gear tests -earth leakage protection, phase sequence & synchronizing – starting time & pick up of load - neutral point earthing.

6. Parallel operation of alternator :load sharing – voltage control-p.f.control sharing of KVA & freq. control - interconnection.

7. Alternator troubles: Instability & loss of field alternator instability -heating & cooling of windings - wear & troubles of slipring, bearings -unbalance rotor & transient torques stec instrument transformer polarities.

8. Commissioning of circuit breakers :fire precaution-oil &compound filling - insulation resistance-H.V. test-mechanical operation & adjustment–relay tests. Relay setting-fuses - preliminary operational tests-purpose of CBs.short circuit - rating of CBs - factors preventing the reforming of arc in CBs. - time for fault clearing

Term work : laboratory work based on above syllabus.

Books for reference :

1. Testing commissioning operation maintainace of Electrical Equipment by S.S. RAO
2. The commissioning of Electrical PlantRCH richardson (Chapman & Hall)

B E Semester VIII (Electrical)
E- 804 Power System Protection

Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory		Practical marks	T/W marks	TOTAL	
			Hrs.	Max Marks	50	25	175	
3	2	0	3	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 , Chaudhary

B E Semester VIII (Electrical)
E- 805 A (Elective Paper – ll) Power System operation and Control

Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory		Practical marks	T/W marks	TOTAL	
			Hrs.	Max Marks	50	25	175	
4	2	0	3	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
Power System Dynamics – K. R. Padhiyar
Modern Power System Planning – X – Wang
Electrical Power System – A. S. Pabla
Electric Power System - Weedy

B E Semester VIII (Electrical)
E- 805 B(Elective Paper II) Digital Signal Processing in Electrical Engineering

Teaching Scheme			Examination Scheme				
Theory	Practical	Tutorial	Theory		Practical marks	T/W marks	TOTAL
			Hrs.	Max Marks	50	25	175
4	2	0	3	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, Introduction 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.

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
DSP by B. C. Kuo

B E Semester VIII (Electrical)
E- 806 Project.

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Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory		Practical marks	T/W marks	TOTAL	
			Hrs.	Max Marks	50	25	75	
0	2	0		00				

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.