STUDY AND EVALUATION SCHEME FOR ELECTRICAL ENGINEERING (2010)

SEMESTER - IV

Code No. EE-	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
		L	T	P	Internal Assessment		External Assessment Exam				
					Theory	Practical	Written Paper		Practical		
					Max Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
401	Electrical Machines-II	4	1	3	50	50	100	3	50	3	250
402	Electronic Devices, Circuits & applications-II	4	0	3	50	50	100	3	50	3	250
403	Transmission and Distribution of Electrical Power	3	2	0	50	0	100	3	0	0	150
404	Control Systems	4	1	4	50	50	100	3	50	3	250
405	Electrical Engineering Drawing	0	0	6		50	100	3		-	150
406	Electrical Workshop Practice-II	0	0	4	0	50	0	0	100	3	150
**	Student Centered activities	0	0	1	-	-	-	-	-	-	-
	TOTAL	15	4	21	200	250	500	-	250	-	120

^{**} Student centered activities will include: extension lectures, field visits, Soft Skills, seminary debates, hobby clubs, library studies, awareness regarding ecology and environment, conservation of energy (Petroleum products, electricity etc), social service camps and other co-curricular activities including games. Advanced planning for each semester has got to be made

EE 401 - ELECTRICAL MACHINES - II

L T P

RATIONALE

The purpose of including electrical machines in this diploma course is already explained under Electrical Machines-I. The remaining topics of electrical machines namely, synchronous machines, poly-phase induction motors, single phase induction motors, commutator motors and special types of other electrical machines are included here.

NOTE: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

UNIT I :- Alternator Principles and Construction :- 20%

Basic principle of alternators- types of alternators- stationery armature rotating field – advantages of rotating field- construction details of alternator- salient pole rotor- cylindrical type rotor- types of AC armature windings- types of slots- full pitch windings and short pitch winding phase spread and effect of distribution- breadth factor- pitch factor-frequency and number of poles – emf equation- problems- methods of obtaining sine waves- critical speed of rotor- ventilation of turbo alternators- advantages of hydrogen cooling and its precaution-excitation and exciters – factors causing instability.

UNIT II :-Alternator Performance and Testing :- 25%

Load characteristics of alternators- reasons for change in terminal voltage- qualitative treatment of armature reaction for various power factor loads- effective resistance- leakage reactance- synchronous reactance, synchronous impedance- regulation- determination of regulation by synchronous impedence method and mmf method.

Necessity and conditions for parallel operation of alternators-synchronising- dark lamp method, bright lamp method and dark and bright lamp method and using synchroscope-synchronising current, synchronizing power and synchronizing torque- effect of changing the excitation of alternators when in parallel- load sharing of alternators when in parallel-control of reactive load, bus bar voltage, and frequency- alternator on infinite bus bargovernor characteristics.

UNIT III :-Three Phase Induction Motors:- 25%

Rotating magnetic field- principle of operation of three phase induction motors- slip and slip frequency- comparison between cage and slip ring induction motors- development of phasor diagram of three phase induction motors- expression for torque in synchronous watts- slip torque characteristics- stable and unstable region- no load test and blocked rotor test-development of approximate equivalent circuit- problems on the above topics- simplified circle diagram- determination of maximum torque, slip etc. (no problems)- starting torque and starting current expression- relationship between starting torque and full load torque-

speed control by injected e.m.f. method, polchanging method, rotor resistance method and cascading method- starters of induction motors- direct on line starter and its merits for cage motors rotor resistance starter- auto transformer starter- star delta starter- crawling speed of motors- cogging- double cage rotor- linear induction motor.

UNIT IV) :- Single Phase Induction Motor

15%

Why single phase induction motors are not self starting-methods of making it self starting – construction, working principle and applications of i) split phase motor ii) capacitor motor iii) shaded pole motor iv) repulsion motor v) universal motor – operation of three phase cage motor from single phase supply – single phase induction regulator.

UNIT V) :- Synchronous Motors

15%

Principle of operation –methods of starting of synchronous motor- armature current as a function of excitation – 'V' curve and inverted 'V' curve of synchronous motor – condition for unity power factor – the phenomenon of hunting and prevention of hunting by damper winding – comparison between synchronous motor and three phase induction motor – problems on power factor improvement.

EE 401 - Electrical Machines - II (Practical)

- 1. Synchronous machines:
 - 1.1 Determination of the magnetisation curve of an alternator (i) at rated speed and (ii) half rated speed.
 - 1.2 Determination of Excitation required to maintain constant voltage in an alternator at varying load
 - 1.3 Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant.
 - 1.4 Determination of the regulation and efficiency of alternator from the open circuit and short circuit test
 - 1.5 Parallel operation of polyphase alternators and load sharing
 - 1.6 Determination of the effect of variation of excitation on a synchronous motor

2. Induction machines:

- 2.1 Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor.
- 2.2 Determination of effect of rotor resistance on torque speed curve of an induction motor and finding out the effect of single phasing

3. FKW Motors:

Determination of the effect of various capacitors on the starting and running of a single phase induction motor. Methods of reversal of rotation.

EE 402- ELECTRONIC DEVICES, CIRCUITS & APPLICATIONS -II

L T P 4 0 3

RATIONALE

At present electronic gadgets are being extensively used in manufacturing processes in industries, power system operations, communication systems, computers etc. Even for a electrical diploma holder it is absolutely necessary to have a basic understanding of electronic components, their fuctions and applications. This understanding should facilitate in operation and maintenance equipment which are electronically controlled.

NOTE: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

1. Transistor Audio Power Amplifier: (15%)

- 1.1 Difference between voltage and power amplifier
- 1.2 Important terms in Power Amplifier; collector efficiency, distortation and dissipation capability
- 1.3 Classification of power amplifier: class A, B & C
- 1.4 Class A single-ended power amplifier, its working and collector efficiency
- 1.5 Impedance matching in a power amplifier through transformer
- 1.6 Heat sinks in power amplifiers.
- 1.7 Push pull amplifier; circuit details, working, and advantages (No mathematical derivation)
- 1.8 Principles of the working of complementary symmetry push-pull amplifier
- 2. Tuned-Voltage Amplifiers : (No mathematical derivation) (5%)
 Brief idea of tuned-voltage amplifiers
- 3. Feedback in Amplifiers:

(15%)

- 3.1 Feedback, its importance, positive and negative feedback, and their need
- 3.2 Voltage gain of an amplifier with negative feedback Aft=A/(1+AB)
- 3.3 Effect of negative feedback on voltage gain, stability distortion, band width, output and input impedance of an amplifier (No mathematical derivation)
- 3.4 Typical feedback circuits:
 - Effect of removing the emitter by-pass capacitor on an ordinary CE transistor amplifier
 - b) Emitter follower and its applications
- 4. Sinusoidal Oscillators:

(15%)

- 4.1 Sinusoidal Oscillators positive feedback amplifiers
- 4.2 Difference between an oscillator and an alternator
- 4.3 Essentials of an oscillator

- Circuit details and working of LC oscillators viz Tuned Collector, Hartley and 4.4 Colpitt's oscillators
- R-C oscillator circuits; phase shift and Wein bridge oscillator circuits. 4.5
- Introduction to piezoelectric crystal and crystal oscillator circuit. 4.6
- 5. Wave-shaping and Switching Circuits:

(20%)

- Concept of Wave-shaping
- Wave-shaping circuits: 5.2
 - 5.2.1 R-C differentiating and integrating circuits
 - 5.2.2 Diode clipping circuits
 - 5.2.3 Diode clamping circuits
 - 5.2.4 Application of wave-shaping circuits
- Transistor multivibrator circuits 5.3
 - 5.3.1 Transistor as a switch (explanation using CE transistor characteristics)
 - 5.3.2 Collector coupled astable, monostable, bistable multivibrator circuits (explanation, using wave shapes). Brief mention of uses of multivibrators.
 - 5.3.3 Working and applications of transistor inverter circuit using power transistors.
- 6. Working principle of different types of power supplies viz CVTs, UPS, Stabilizers etc.

(10%)

(10%)7. Operational Amplifiers Adder, summer, differentiator, integrator, inverting, amplifier, non-inverting amplifier and voltage follower

(10%)8. Digital Techniques Binary, octal, hexadecimal numbers and its conversion, logic gates, AND, OX, NOT, XOR, X-NOR gates, half adder, full adder.

EE 402- Electronic Devices, Circuits & Applications -II (Practical)

- 1. Familiarity with different electronic components e.g. capacitor, coils, transformers, micro switches, proximity switches heat sinks, IC bars, PCBs, etc.
- 2. To measure voltage gain of first stage and voltage gain of combined two stages, of R-C coupled amplifier working at a particular operating point.
- 3. To plot frequency response curve of R-C coupled amplifier and compare its band width with that of a single-stage amplifier.
- 4. To measure the effect of the change in value of coupling capacitor on lower cut off frequency in two stage R-C coupled amplifier
- 5. To measure (a) optimum load (b) output power in Class A single-ended transistor amplifier
- 6. To measure (a) optimum load (b) output power (c) signal handling capacity in a push-pull amplifier

- 7. To measure voltage gain and plot the frequency response curve of single-stage feedback amplifier when by-pass capacitor is removed.
- 8. To measure (a) Voltage gain, (b) input and output impedance for an emitter follower circuit.
- 9. To measure frequency generated in (a) Hartley (b) Colpitt and (c) Wein bridge oscillators.
- 10. To observe the differentiated and integrated square wave on a CRO for different values of R-C time constant.
- 11. i) Clipping of one portion
 - ii) Clipping of both portion of sine-wave using:
 - a) diode and dc source
 - b) zenor diodes
 - iii) Clamping a sine-wave to:
 - a) negative dc voltage
 - b) positive dc voltage
- 12. To generate square-wave using an astable multivibrator and to observe the wave form on a CRO
- 13. To observe inggering and working of a bistable multivibrator circuit and observe its output wave forms on a CRO.

EE 403- TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER

L T P 3 2 0

RATIONALE

The majority of the polytechnic passouts have to perform various activities in the State Electricity Board in the fields of Generation, Transmission and Distribution of Electrical power. The range of these activities vary from simple administrative jobs to public relations, operation and maintenance of equipments, lines fault location, planning and designing of simple distribution schemes and executive and supervisory control in power stations, transmission and distribution networks.

In order to develop knowledge and skill in the students so that they are able to handle the various jobs as mentioned above, they are expected to be imparted training by framing syllabus including such topics in the subject of Transmission and Distribution and Generation, Switchgear and Protection System.

In order to provide practical orientation to the students, they are expected to visit power stations, sub-stations, and appropriate use of audio-visual aids in these subjects.

They should also be made aware on recent developments, current practices in the Electricity Boards to keep them abreast with modern techniques in Generation, Transmission and Distribution of Electrical Power.

NOTE: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

1. Transmission Systems

(30%)

- 1.1 Layout of transmission system; Effect of increase of voltage on (a) weight of copper (b) efficiency of line and (c) line drop; practical working voltage for generation transmission and distribution.
- 1.2 Comparison between: (a) three phase and single phase system (b) Overhead and underground transmission system, (c) hvac and hvdc transmission system.
- 1.3 Constructional features of transmission lines:

 Types of supports, types of insulators, Selection of insulators, conductors, earth wire and their accessories, Transposition and stringing of lines
- 1.4 Mechanical features of line: Importance of sag, calculation of sag at level supports, effects of wind and ice, simple problems; Indian electricity rules pertaining to clearance
- 1.5 Electrical features of line: Concept of resistance, inductance and capacitance in a.c. transmission line (single phase, three phase); simple problems on efficiency and regulation of short lines; physical concept of corona. Effects of corona and remedial measures
- 1.6 HVDC transmission lines: salient features, advantages, description of system to block diagram, ground return



2. Distribution System:

(30%)

- 2.1 Layout of HT and LT distribution system: Constructional feature of distribution lines and their erection. LT feeder, distributor and service mains; Simple problems on AC distributor fed at one end, both ends and determination of size of conductor
- 2.2 Construction of LT and HT underground power cables, laying of cables, different methods, comparison of overhead and underground distribution systems.
- 2.3 Estimation of LT and HT overhead distribution lines.

3. Substations:

(10%)

- 3.1 Brief idea of substations; grid sub-station 220/132 KV, outdoor power substations, indoor and pole mounted substations
- 3.2 Layout of 33/11 KV distributions substation and various accessories and equipments.
- 3.3 Estimation of 11 KV/440 V pole mounted substation.

4. Faults:

(10%)

- 4.1 Common type of faults in lines (i.e. overhead and underground)
- 4.2 Location and testing of faults in underground cables
- 4.3 Maintenance schedule of lines

5. Power Factor:

(10%)

- 5.1 Concept of power factor
- 5.2 Causes and disadvantages of low power factor
- 5.3 Economics of Power factor improvement, Methods of improvements using static and synchronous condensers and simple problems.

6. Various types of tariffs

(10%)

- 6.1 Types of tariffs
- 6.2 Block rate, flat rate, maximum demand and two part tariffs
- 6.3 Simple problems

Recommended Books:

Power Systems Engineering By D.P. Kothari (TMH Publications)

EE 404-CONTROL SYSTEMS

P

RATIONALE: The students are required to know about the process system which is an important factor of a plant. It is a pre-requisite for understanding the total plant controls. In this subject introduction to theory in control system has been given which will enable the student to understand the process of control system concepts to be covered in the subsequent semesters. Faculty is advised to teach the subject by citing the practical examples.

NOTE: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

1. Introduction to automatic control:

(20%)

Basic elements of control system, definition of terminology used in control system, open loop and closed loop system concepts of feedback, functional block diagram of a control system, time lag, dead time, hysteresis, self-regulating and non self regulating systems, practical examples of the above.

2. Block diagram and transfer function:

(20%)

Review of Laplace transforms, transfer function of simple control components like massspring damper, thermometer single and multi-capacity process, single feedback configuration

3. Time response of systems:

Order of systems, test inputs, step response of first order and second order system-overshoot and undershoot, rise time ,damping ratio, simple examples of first order and second order, steady state response and error.

4. Introduction to stability analysis:

(20%)

Characteristic equation, Routh tables, nyquist criteria, bode plots, relative stability phase margin and gain margin.

5. Routh-hurwitz criterion:

(20%)

Root locus technique, Gain margin

EE 404-Control Systems (Practical)

1. To find the time lag ,overshoot and other parameters of second order system.

- 2. To design and fabricate the first order system for temperature or flow or pressure of level from simulated input.
- 3. To find transfer function of RC-circuit by bode plot.

4. To study LVDT and characteristics.

- 5. To study torque speed characteristic of ac servo motor with the help of mechanical /magnetic loading.
- 6. To study the synchrose

7. To study stepper motor

8. To study frequency domain technique using MATLAB of Bode Plot, Polar Plot, Root locus, Time lag, Routh Hurwitz

Recommended Books:-

Control system by Ogatta, Control system by Nagrath Kothari, Control system by N.K. Jain (Dhanpatrai Publishing House)

EE 405 - ELECTRICAL ENGINEERING DRAWING

RATIONALE

A diploma holder in Electrical Engineering is supposed to have good knowledge of designing wiring schemes for domestic and power installation and also to draw layouts for wiring diagram, so that execution job can be undertaken. He is also required to understand and interpret the drawings prepared by others. He should be familiar with the Indian standards and relevant Indian Electricity Rules. The design of the curriculum of this subject is done keeping in view the above requirements.

NOTE: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

UNIT I:- SYMBOLS & LIGHT CIRCUITS

(20%)

- 1. Electrical & Electronic symbols used in installation like alarms, control points etc,.
- 2. Light & Fans points controlled from individual switches.
- 3. Flourescent tube controlled from one switch.
- 4. One lamp controlled by two switches.
- 5. Two lamps controlled by three switches.
- 6. One bell controlled by one push button.
- 7\Two bell (for day & night) used at Doctor's Residence.
- 8. Bell response circuit using one bell & a realy.
- 9. Bell response circuit of an office.
- 10. A light circuit which gets automatically connected to DC supply in case of power failure.

(20%)UNIT II :- Connection Diagrams and Wiring Diagrams.

Sketch neatly the following:-

- 1. Connection diagram of different types of D.C. Generators.
- 2. Wiring circuit of sodium vapour lamp, high pressure mercury vapour lamp
- 3. Wiring of circuit of Refrigerator and Air conditioner.
- 4. Wiring circuit of Automatic Electric Iron.
- 5. Wring circuit of Over head projector.
- 6. Wiring circuit of water heater.
- 7. Wiring circuit of Battery charger.
- 8. Panel wiring diagram of parallel operation of two D.C. Compound Generators.
- 9. Panel wiring diagram of parallel operation of three Phase alternators. (Dark lamp, bright lamp, Syncroscope).

UNIT III :- House Wiring

(20%)

Installation Plan, single line wiring diagram, selection and rating of necessary equipment and to prepare a list of material required for electrical wiring of a small house (In batten/concealed conduit system). Determination of sizes of distribution boards for multistoried buildings. Introduction to concept of rate schedule.

UNIT IV :- Service Line Connection:-

(20%)

Layout diagram (from supply pole to building) and to prepare a list of materials required for giving a service line connection (single phase & three- phase small loads).

UNIT V:- Power Wiring for a Small Workshop:-

(20%)

Installation plan, single line wiring diagram, selection & rating of necessary equipment & to prepare a list of materials required for a small workshop. Determination of sizes of panel for given loads. Introduction of concept of rate schedule.

- 1. Single line circuit & layout plan of 11/0.4 KV indoor substation (i.e. key diagram)
- 2. Single line circuit & layout plan of 66/11/0.4 KV outdoor substation with 11KV indoor switchgear (key diagram).

Recommended Books:-

Electrical Engineering Drawing by Surjit Singh Electrical Estimating & Costing by S.K. Bhattacharya

EE 406 - ELECTRICAL WORKSHOP PRACTICE - II

RATIONALE

When working as a supervisor, an electrical diploma holder technician will be called upon to inspect, test and modify the work done and installation made by skilled workers or artisans working under him. In addition, many a times he himself has to test installations, control panels, and to check the circuit connections and to demonstrate the correct method and procedure of doing certain operation. In order to carry out these functions of repairs, installation and testing effectively in addition to conceptual understanding of methods or procedure he must also possess manual skills.

This subject aims at developing special skills required for doing industrial installation, laying cables, earthing, installing motors with their accessories, wiring testing of contract or control circuits and motor winding.

DETAILED CONTENTS

UNIT 1:-Wiring, Testing & Faults- detecting of the following contractor control circuits operating on 3- phase supply.

- Remote control circuits. i)
- Time delay circuits. ii)
- Inter locking circuits. iii)
- Sequential operation control circuits. iv)

UNIT 2:- To Carry Out- Pipe earthing for a small house or a small 3-phase motor.

UNIT 3:- Installation- of a 3-phase motor with main switch & starter.

UNIT 4:- Dismantling, assembling & repair of DOL starter & star delta starter.

UNIT 5:- Winding/ Re- Winding- of a Fan & Choke.

UNIT 6 :- Fault Finding- in single phase & three phase motors & their rectification.

UNIT 7: - single-phase and three-phase Motor Winding.

UNIT 8:- Power Cable - Jointing (Demonstration, if kit not available).

UNIT 9:- Laying of- under-ground cables (Demonstration).

(at least five experiments in each part are to be completed)