STUDY AND EVALUATION SCHEME
FOR
ELECTRICAL ENGINEERING (2010)

SEMESTER - III

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	
301	Electrical Circuit	4	0	3	50	50	100	3	50	3	250
302	Electrical Machines-I	4	1	3	50	50	100	3	50	3	250
303	Electronic Devices, Circuits & applications-I	4	0	3	50	50	100	3	50	3	250
304	Electrical Measurements and Measuring Instruments	4	0	3	50	50	100	3	50	3	250
305	Computer Aided Design	1	0	4	-	50	-	3	50	3	100
306	Electrical Workshop Practice-1	-	-	4	0	50	0	0	50	3	100
**	**Student Centered activities**	-	-	2	-	-	-	-	-	-	-
	TOTAL	17	1	22	200	300	400	-	300	-	1200

** Student centered activities will include: extension lectures, field visits, Soft Skills, seminars, 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-301- ELECTRICAL CIRCUIT

L	T	P
4	0	3

RATIONALE

Electrical Circuit is a subject where a student will deal with various laws, theorems and circuits related to electrical engineering. After studying this subject an electrical diploma holder must be competent to repair/maintenance/implementation of various AC/DC circuits needed in working field.

DETAILED CONTENTS

Unit I: **(15%)**

Basic concepts- current, emf, potential difference, resistance, inductance, capacitance, resistivity, electric flux, flux density, field intensity, electric potential, work, power & energy - Ohm's law, Kirchoff's law, Coulomb's law of electrostatics, relationship between voltage, charge & capacitance resistors in series and parallel, capacitors in series and parallel, Numericals on the above topics.

Unit II: **(30%)**

Circuit Theorems(D.C-circuits)- Mesh equation, Nodal equation, star / delta transformation, Superposition theorem, Maximum power transfer theorem, Thevenin's theorem, Norton's theorem. Numericals on the above topics in respect of D.C. Circuit only.

Unit III: **(20%)**

Single Phase Circuits- Definition of instantaneous value, peak value, effective value, average value, form factor, peak factor, Reactance, Impedance, conductance, susceptance, admittance, Phase angle, power factor- calculate the instantaneous value of current & voltage, frequency of the sinusoidal alternating quantity from instantaneous value, current in both branches of a two branch parallel circuit, total current, power and power factor of a parallel circuit.

Concepts of: Rectangular and polar co-ordinates, Sinusoidal voltage and current. Pure resistive, inductive and capacitive networks. RL,RC and RLC series and parallel circuits.

Numericals on the above topics in respect of A.C. Circuit.

Unit IV: **(15%)**

Polyphase Circuits- Series resonance, parallel resonance, condition of resonance in series and parallel circuits. Half power frequency, bandwidth, Q factor, advantages of 3 phase system over single phase system.

Draw phasor diagram for balanced and un balanced star and delta connected load and determine the relationship between phase and line quantities. Calculate line current, phase current, phase voltage and power for star and delta connected loads. Two wattmeter method of power measurement.

Unit V: **(20%)**

Graph Theory: Introduction, concept of graphs of the networks, trees and their properties,incidence matrix, fundamental tie-set matrix, fundamental cut-set matrix, equilibrium equations on loop and node bases and their solutions.
Two-Port Network: Introduction, Different parameters and relationship between different parameters, inter-connections of two port networks, open circuit and short- circuit impedances and ABCD constants, image impedance, image parameters.

EE-301- ELECTRICAL CIRCUIT (PRACTICAL)

1. Verification of Kirchoff's laws.
2. To find the equivalent value of resistors connected in parallel.
3. To find the equivalent value of capacitors connected in series.
4. Verifications of Network Theorem-Thevenin Theorems.
5. Verifications of Network Theorem- Norton Theorems.
6. Verifications of Network Theorem- Superposition Theorems.
7. Power measurement by Two Wattmeter method to prove sum of two wattmeter reading equals total power.
8. Power measurement by 3 ammeters and 3 voltmeters.
9. Study of resonance.
10. Study circuit transients by Digital Simulation.
11. Study of unbalanced circuits using symmetrical components (balanced circuit with unbalanced source only).
12. Study of CRO and Power factor measurement using CRO.
13. Measurement of two-port parameter.

(Minimum of Ten experiments to be conducted)

EE 302 ELECTRICAL MACHINES-I

L	T	P
4	1	3

RATIONALE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

DETAILED CONTENTS

1. Introduction to Electrical Machines (6 hrs)
   - 1.1 Definition of motor and generator
   - 1.2 Torque development due to alignment of two fields and the concept of torque angle
   - 1.3 Electro-magnetically induced emf
   - 1.4 Elementary concept of an electrical machine
   - 1.5 Comparison of generator and motor
   - 1.6 Generalised theory of electrical machines

2. DC Machines (24 hrs)
   - 2.1 Main constructional features, Types of armature winding
   - 2.2 Function of the commutator for motoring and generation action
   - 2.3 Factors determining induced emf equation
   - 2.4 Factors determining the electromagnetic torque
   - 2.5 Significance of types of machines
   - 2.6 Significance of back e.m.f., the relation between back emf and Terminal voltage
   - 2.7 Performance and characteristics of different types of DC motors
   - 2.8 Speed control of dc shunt/series motors
   - 2.9 Need of starter, three point dc shunt motor starter and 4 point starter
   - 2.10 Applications of DC motors
   - 2.11 Faults in dc machines and their retrospective
   - 2.12 Losses in a DC machine
   - 2.13 Determine of losses by Swinburns test

3. Transformers (single phase) (24 hrs)
   - 3.1 Introduction
   - 3.2 Constructional features of a transformer and parts of transformer
   - 3.3 Working principle of a transformer
   - 3.4 EMF equation
   - 3.5 Transformer on no-load and its phasor diagram
   - 3.6 Transformer on load (including voltage drops and its phasor diagram)

3.7 Transformer – neglecting voltage drop in the windings – Ampere turn balance – its phasor diagram
3.8 Mutual and leakage fluxes, leakage reactance
3.9 Equivalent circuit
3.10 Relation between induced emf and terminal voltage, regulation of a transformer mathematical relation
3.11 Losses in a transformer
3.12 Open circuit and short circuit test. Calculation for efficiency, condition for
3.13 maximum efficiency
3.14 Cooling of transformer, conservator
3.15 Auto transformer construction, working and applications
3.16 Different types of transformers

4. Three phase Transformers (10 hrs)
   4.1 Construction of three phase transformer
   4.2 Types of three phase transformer i.e. delta-delta, delta-star, star-delta and starstar
   4.3 Conditions for parallel operation (only conditions are to be studied)
   4.4 On load tap changer, ON/OFF load tap changer
   4.5 Difference between power and distribution transformer
   4.6 Cooling of transformer

EE 302 ELECTRICAL MACHINES-I (PRACTICALS)

1. Introduction to electrical machines Measurement of the angular displacement of rotor of the three phase synchronous machine with respect to the stator on application of DC to the field winding and simultaneously to each phase-winding in sequence

OR

1. Measurement of the angular displacement of the rotor of a slip-ring induction motor on application of DC to stator of motor winding in sequence and simultaneously to each phase of rotor winding

2. DC machines
   2.1 Speed control of dc shunt motor (i) Armature control method (ii) Field control method
   2.2 Study of dc series motor with starter (to operate the motor on no load for a moment)
   2.3 Determination of efficiency of DC motor by swinburns test at (i) rated capacity (ii) half full load
   2.4 Measurement of terminal voltage of a DC shunt generator as a function of load current.
   2.5 Measurement of induced e.m.f. of a separately excited DC machine as a function of field current.

3. Transformers (single phase)
   - 3.1 To perform open circuit and short circuit test for determining equivalent circuit parameter of a transformer
   - 3.2 To determine the regulation and efficiency from the data obtained from open circuit and short circuit test at full load
   - 3.3 Measurement of losses and voltage in cage of a short circuit transformer as a function of current

4. Three-phase transformers
   - 4.1 Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations
   - 4.2 Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations conditions

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Machines by SB Gupta, SK Kataria and Sons, New Delhi

EE 303- ELECTRONIC DEVICES, CIRCUITS & APPLICATIONS –I

L	T	P
4	0	3

RATIONALE

The purpose of the introduction of electronics in the electrical engineering diploma course has been already explained in the rationale of the subject Basic Electronics. In this course, topics like Amplifiers and wave shape circuits have been dealt with.

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

DETAILED CONTENTS

UNIT 1- Electronic Passive and Active Components and CRO. (25%)

Passive Components:- Resistors- Types – Materials- Colour code- Specification. Inductors- Types- Specification. Capacitors- Types- Specification. Active Components:- Review of Semiconductor Diodes – junction Transistors- Principal of Operation and Characteristics of :- 1. NPN & PNP Transistors in different configurations- 2. Injunction Transistors.- 3. Field Effect transistor.- 4. MOSFET (Depletion and Enhancement Mode) – Comparison between JFET and MOSFET. Cathode Ray Oscilloscope:- CRO block diagram- Operation- Cathode Ray Tube- Electron Gun Electron Beam focusing systems and deflection systems (Descriptive Treatment only. No problems)- Fluorescent screen- Accelerating voltage- Time base- CRO controls- CRO applications.

UNIT 1I Special Semiconductor devices and I.C. Fabrication. (25%)

Principal of Operation, Characteristics and applications of :- pn junction diode, Zener Diode, GUNN diode, Tunnel Diode, Varactor Diode, Thyristers- Types-SCR, FET, MOSFET, UJT, Triac, Diac, Quadrac, Gate Trigger on Device, LDR, Photo Diode, Solar Cell, LED, LCD. Introduction to IC technology-Step by Step process of Integrated resistor, Integrated Capacitors, Integrated Transistors, Integrated Diodes.

UNIT III- Rectifiers, Filters and Power supplies. (25%)

Circuit and operation of :- 1. Half wave rectifiers- 2. Full wave rectifiers- 3. Bridge rectifiers- Comparison of Rectifiers (Description Only)- Three phase Rectifiers (Halfwave, Fullwave) circuit and operation.

Fitters- Types- Operation of 1. Capacitor Filter- 2. LC Filter Bleeder resistor- 3. PI Filter- 4. RC Filter (Circuit and description only).

Regulated power Supply- Types- Circuit and principal of operation of :- 1. Zener Voltage Regulator- 2. Series Regulated Power Supply with Over Load Protection- 3. Positive Voltage Regulator using IC 78xx and Negative Voltage Regulator using IC 79xx.- Basic Concept of SMPS and UPS (Block Diagram and explanation only).

Half wave and Full wave Voltage Doubler- Clippers and Clampers (Using Diodes only.)

UNIT IV- Amplifier. (25%)

Definitions- General Classification of Amplifiers- CB, CC, CE Amplifier principals and operation- Comparison of their Characteristics with repect to voltage gain, current gain, input impedance and output impedance.

Cascaded Amplifiers- RC coupled amplifier- Frequency response curve- dB notation- definition of Lower cut off frequency and Upper cut off frequency – Band width. Distortion in amplifiers- noise in amplifiers. Emitter Follower- Darlington Emitter Follower- Darlington Emitter Follower- Direct Coupled Amplifiers (Common Emitter connection only)- differential Amplifier.

ELECTRONIC DEVICES, CIRCUITS & APPLICATIONS –I (PRACTICAL)

1. Identification of electronic components; Passive components such as R, L and C, their types, ratings and specifications and colour code. Active components such as diodes and transistors.

2. Plotting V-I characteristic of a semi-conductor diode and finding its dynamic resistance.

3. Plotting V-I characteristics of Zener diode and finding its reverse breakdown voltage.

4. Observation of input and output wave shapes and verification of relationship between dc output voltage and ac input voltage for a half-wave rectifier.

5. Observation of input and output wave shapes and verification of relationship between dc output volotage and ac input voltage for a full-wave rectifier.

6. Observation of output wave shapes of a full-wave rectifier with (a) shunt capacitor (b) series inductor (c) TT filter circuit.

7. Plotting input and output characteristics of a transistor in CB configuration.

8. Plotting input and output characteristics of a transistor in CE configuration.

9. Measurement of operating point {collector current (Ic), and collector emitter voltage, V} in case of : CE

   9.1 Fixed base biasing of a transistor
   9.2 Potential divider biasing of a transistor

10. To observe and note the effect on the performance of a transistor due to change in temperature, also observe the effect on the performance on replacing the transistor by the same number.

11. To measure the voltage gain and to observe and plot phase reversal of signal with CRO for a single-stage transistor amplifier.

12. To plot frequency response curve of a single-stage transistor amplifier.

13. To plot Characteristics of a Field Effect Transistor (FET).

Recommended Books:

Electronics devices & circuits by Kulshetra & Mathur (TMH Publication)
Electronics principles by Malvino (TMH Publication)

EE304 - ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

L	T	P
4	0	3

RATIONALE

Diploma holding technician has to work on various jobs in field as well as in testing laboratories and on control panels, where he performs the duties of installation, operation, maintenance and testing of measuring instruments. Technician working on control panels in power plants, substation and in industries will come across use of various types of instruments and has to take measurements.

Instruments used to read and observe the general electrical quantities like current, voltage, power, energy, frequency, resistance etc. And their work shapes, have been incorporated in this subject. So the technician will know the construction and use of various types of instruments.

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

DETAILED CONTENTS

UNIT I – Characteristics and classification of Instruments. (25%)

Definition – true value- accuracy- precision errors – correction –sensitivity- resolution- instrument efficiency.

Classification:- Absolute and secondary instruments- indicating, integrating and recording instruments- Effects utilized in instruments.

Operating Forces:- Deflecting, controlling and damping- control system- comparison of spring and gravity control-damping system- constructional details-types of supports- balancing- torque weight ratio.

Recorders :- Types of recorder-xy recorder-strip chart recorder, magnetic tape recorder.

UNIT II – Measurement of Current, Voltage and Resistance. (25%)

Classification of ammeters voltmeters- constructional features theory of working of moving iron. (attraction, repulsion) and permanent magnet moving coil meters as ammeters and voltmeters-errors measurement after rectification.

Extension of instrument range:- shunts and multipliers- problems, instrument transformers- principle of working-connection in a circuit –rating , ratio and phase angle error (definition and formula only) effect of sudden opening of secondary of CT.

Measurement of resistance: Classification (low, medium, high), construction and working principle of ohmmeter, megger and multimeter.

UNIT III – Measurement of Power and Energy. (25%)

Classification of wattmeters- dynamometer wattmeter construction- theory of operation- low p.f. wattmeter- two element three phase wattmeter- construction principle of working of induction type single phase energy meter –testing with RSS meter-phantom loading and phase shift-errors and adjustment-creep and prevention-3 phase energy meter construction

and connection in the circuit-use of CT and PT for energy measurement – construction and principle of working of dynamometer type power factor meter- single phase and three phase.

UNIT IV- Special Instruments. **(25%)**

Study of earth tester

AC Bridges:- Anderson bridge for measurement of inductance, schering bridge for measurement of capacitance (No derivation, formulae under balanced condition only).

Cable fault location- murray and variac loop tests.

Synchroscope:- Construction, working of Weston synchroscope Phase sequence meter:- Construction, Principle of working of rotating type indicator.

Maximum demand tariff-types of M.D. Indicators- operation of trivector meter (Landys and Gyr). Frequency Meters:- Mechanical resonance type- electrical resonance type-Weston frequency meter-principle of working of digital frequency meter-electronic voltmeter-advantages-FET voltmeter- digital voltmeter. Integrated measuring digital instrument (for measuring electrical power in KW, KVA, KVAR etc) (Power manager).

EE304 - Electrical Measurements and Measuring Instruments (Practical)

1. Use of multimeter for measuring voltage, current and resistance.
2. To calibrate 1-phase energy meter by direct loading method.
3. To measure the value of earth resistance.
4. To measure power, power factor in a 1-phse circuit, using wattmeter and power factor meter and verify results with calculations.
5. Measurement of power and power factor of a three-phase balanced load by 2-wattmeter methods.
6. Measurement of voltage, frequency of a Sinusoidal Signal with CRO.
7. Measurement of power in a 3-phase circuit using CT, PT and 3-phase energy meter.
8. Connecting appropriate instruments at the supply of an installation to measure supply voltage, frequency, power maximum demand, Phase sequence, energy consumed. (Instruments to be used are CRO, VTVM, Maximum demand Indicator, phase sequence indicator, Energy meter and power factor meter)
9. Use of LCR meter for measuring inductance, capacitance and resistance.
10. Connection of 3-phase energy meter in an electrical system for measurement of energy.

Recommended Books:

Electrical measurements & instrumentation by A.K. Sawhney

EE305 COMPUTER AIDED DESIGN

L	T	P
1	0	4

RATIONALE

CAD is used to create digital models of circuit boards, switch board drawings and utility designs. As energy consumption of currently at the fore front of public consciousness, CAD software technology is currently being used to design more efficient electrical systems which can enable energy savings. Engineers using CAD designed "Smart Grids" can more accurately measure power flow. A smart grid can "integrate smart devices, switches, meters, and sensors to expand real-time information ablut electric and water network activities" (Autodesk / CAD Star)

DETAILED CONTENTS

UNIT - I :-Programming in C/C++ (20%)

(i) Basic structure of C program
(ii) Executing a C Program
(iii) Identifies & keywords, data types, constants, variable
(iv) Operators, expressions & statements
(v) Library functions
(vi) Managing input-output operations, like reading a character, writing a character, formatted input, formatted output through print, scanf, getch, putch statements etc.

Basic of MAT Lab & its applications.

UNIT - II :- SYMBOLS & LIGHT CIRCUITS (20%)

Basic concepts of co-ordinate systems in Auto CAD. Draw simple shapes like circle, square, triangle using Auto CAD using all the three co-ordinate systems.

i) Light & Fans points controlled from individual switches.
ii) Flourescent tube controlled from one switch
iii) One lamp controlled by two switches
iv) Two lamps controlled by three switches
v) A light circuit which gets automatically connected to DC supply in case of power failure.

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 & there phase small loads).

UNIT V: - POWER WIRING (20%)

i) Single line circuit & layout plan of 11/0.4 KV indoor substation (i.e. key diagram)
ii) Single line circuit & Layout plan of 66/11/0.4 KV outdoor substation with 11KV indoor switch gear (key diagram).

EE 306 - ELECTRICAL WORKSHOP PRACTICE - I

L	T	P
0	0	4

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

1. Introduction of Electrical Accessories & wiring materials used in workshop.
2. Introduction of tools used in electrical workshop.
3. Unsheathing of wire baring & bending ears of solid wires.
4. Study of safety & shock treatments.
5. Soldering of thimbles to standard wires.
6. Crimping of thimbles.
7. WIRE-JOINTING:-
   - i) Straight married joint
   - ii) T- joint
   - iii) Western union joint
   - iv) Britannia joint
   - v) Twist sleeve joint
   - vi) Botled type joint
8. Types of wiring & to make different lamp control circuits in following wiring system:-
   - i) Cleat wiring
   - ii) Batten wiring
   - iii) Conduit wiring
9. To make a main distribution board with four outgoing circuits for light & fan loads including main switch & fuses.
10. To make a switch board containing at least two switches for fan regulator & socket.
11. To make an extension board with two 5A sockets & one 15A socket controlled by their respective switches. Also to provide a fuse and an indicators.
12. Testing of domestic wiring circuit with the help of Meggar.
13. Fault finding and repair of a tube light circuit & CFL
14. Wiring & testing of alarm and indicating circuits using relay, push button & Bells (Simple single phase circuits).