STUDY AND EVALUATION SCHEME
FOR
ELECTRICAL ENGINEERING (2010)

SEMESTER - VI

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	
601	Installation commissioning & Maintenance of Electrical Equipments	4	0	4	50	50	100	3	50	3	250
602	Utilisation of Electrical Energy	4	0	4	50	50	100	3	50	3	250
+CM 501	Industrial Engineering & Management	4	0	0	50	-	100	3	-	-	150
603	Elective – II	4	0	4	50	50	100	3	50	3	250
604	Major Project	-	-	8	-	50	-	-	150	3	200
**	**Student Centered activities**			4	-	-	-	-	-	-	-
	TOTAL	**16**	**0**	**24**	**200**	**200**	**400**	**-**	**300**	**3**	**1100**

Elective – II

A. Industrial Electronics & Control of Drives
B. Repair & Maintenance of Electrical Equipments
C. Special Electrical Machines
D. Power System Protection

** 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

+ Subjects common with Mechanical, Production, Automobile Engineering

EE-601- INSTALLATION COMMISSIONING AND MAINTENANCE OF ELECTRICAL EQUIPMENT

L	T	P
4	0	3

RATIONALE

Many of the electrical technicians employed in state electricity Boards of other electrical industries are engaged in installation, maintenance and repair of various type of electrical equipment .This may include generation, transmission and distribution systems. Normally manufacturers of heavy electrical equipment provide service manuals, instructions for installation, maintenance and fault location.

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

1. Knowledge of Indian electricity rules, safety codes and requirements, causes and prevention of accidents, procedure on occurrence of accidents, first aid, artificial respiration, investigation and management of accidents ,workmen's safety devices and periodical inspection of safety devices.
2. Domestic Installation:- Introduction , testing of electrical installation of a building, testing of insulation resistance to earth, testing of insulation and resistance between conductors continuity or open circuit test, short circuit test, testing of earthling continuity, polarity test, localization of faults, IE rules for domestic installation
3. Maintenance concepts, types of maintenance, maintenance schedules, maintenance management, history cards and job cards.
4. Transmission and Distribution System: Caution notice, Authorized persons ,danger notice, permit to work,arranging of shutdowns personally and telephonically foreign voltages and lines in the vicinity, location of local/ temporary earthcancellation of permit and restoration of supply.Patrolling and inspection of lines- patrol books and line maintenance registers, frequency and schedule of patrolling points to be noted during patrolling from ground; special inspections; night inspections; emergency inspection support –head inspections; measurement of clearance of overhead lines; location of underground cables and rectifying the same. Open or loose neutral connection and non - provision of fuses on service lines and their effects on system, dim and filtering lights.
5. Distribution transformer : Transformer maintenance register, schedule of maintenance, points to be attended to in respect of various items of equipment's such as distribution transformer. LT switch, lightening arrestors, insulators, cross arms, gang operating switch, conductors/earth wire, guys, earthling, foundations etc. Checking of insulation resistance of earth resistance, transformer oil level and BDV test of oil, measurement of earth resistance, balancing of phases, dangerous situations due to higher earth resistance, improvement of earth resistance value, grounded neutral.
6. Grid Substations:- Checking and maintenance of bus-bars, isolating switches, voltage and current transformers, lightening arrestors, control and relay panels, shunt capacitors,

HT/LT circuit breakers, I.T switches, power transformers and their dehydration oil tests, earthing system and batteries.

7. Installation, testing and commissioning of electrical installations in a big industry including high voltage transformers and its connected equipment in the switch yard, medium voltage distribution panels, power control centres, motor control centres, lighting arrangement, storage, pre-installation checks, installation, alignment, connecting and starting, pre-commissioning checks, drying out, Causes of fire, precautions to avoid fire, types of fire fighting equipment and their uses. Commissioning of fire fighting equipment.
8. Batteries : Construction, working and application of lead acid battery , alkaline (Ni-Fe and Ni-Cd) batteries, maintenance of lead acid battery, alkaline battery and Nickel Cadmium battery, methods of charging, specification of battery , factors affecting battery life.
9. Fire fighting system :
   (i) Wet riser system, Dry riser system, Sprinkler system:- Design of system
   (ii) Fire alarm system:- Detectors
   (iii) Fire safety equipments
10. Water supply system:- Selection of pumpsets and types of pumpsets

NOTE: Extensions lecturers from fields experts be organized on specialized topics

EE-601- Installation Commissioning and Maintenance of Electrical Equipment (PRACTICAL)

1. Study and handling of tools and accessories for installing heavy equipments.
2. Testing of electric equipments before commissioning.
3. Study of commissioning of electrical equipments.
4. Testing of Industrial wiring.
5. Measurement of earth resistance.
6. Testing and maintenance of Batteries.
7. Battery charging by constant current and constant voltage methods.
8. Overhaulling of electrical machines/ Gadgets.
9. Repair and maintenance of domestic electrical appliances e.g electric iron, gyser, fan, heat convector , washing machine, room cooler etc.
10. Connection of single phase and three phase motors through appropriate starter and to change their direction of rotation.
11. Study of fire fighting system at VVIP buildings / Projects.

EE602 UTILISATION OF ELECTRICAL ENERGY

L	T	P
4	0	4

RATIONALE

This subject assumes importance in view of the fact that the technician has to work in a wide spectrum of activities wherein he has to make collection from alternative schemes from technical and economical consideration to plan and design using basic principal and handbook, to select equipment processes and components in different situations. The curriculum has been designed keeping the above objective in view Beside giving him basic knowledge in the topics concerned attempts have been made to ensure that the knowledge acquired is applied in various fields as per his job requirements. To orient the subject matter in the proper direction, visits to industrial establishment are recommended in order to familiarize the students with the new developments in different areas

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

DETAILED CONTENT

1. ILLUMINATION
   - 1.1 Nature of light, curve of relativity of human eye and wavelength
   - 1.2 Definition: flux, solid angles, luminous intensity, illumination , luminous efficiency depreciation factor coefficient of utilization , space to height ratio, reflection factor. Laws of illumination.
   - 1.3 calculation of number of light points for interior illumination ,calculation of illumination at different points, consideration, involved in sample design problem and illumination schemes , indoor and outdoor illumination level.
   - 1.4 Different sources of light: Difference between incandescent and discharge lamp- their construction and characteristics, fittings required for filament lamp, mercury lamp, Fluorescent lamp, sodium lamp, neon lamp, halogen lamp, compact of fluorescent lamp.
   - 1.5 Main requirements of proper lightning; absence of glare contrast and shadow
   - 1.6 Principles of street lighting.

2. Electric Heating:
   - i) Introduction
   - ii) Advantages of electrical heating
   - iii) Heating methods
     - a. Resistance heating (direct resistance heating, indirect resistance heating, electric ovens and their temperature range properties of heating elements, domestic water heaters and other heating appliances.
     - b. Induction heating; principle; core type and coreless induction furnace.
     - c. Electric arc heating; direct and indirect arc heating; arc furnace
     - d. Dielectric heating, applications in various industrial fields

iv) Simple design problems of resistance heating element

3. Electric welding
   a) Welding methods, principles of resistance welding, welding equipment
   b) Principle of arc production, electric arc welding principle, characteristics of arc; carbon and metallic arc welding, power supply, advantage of coated electrode, comparison of AC and DC arc welding; welding control and welding control circuits.

4. Electrochemical processes
   a) Need of electro-deposition
   b) Application of faraday's laws in electro-deposition
   c) Objectives of electroplating
   d) Factors governing electro deposition
   e) Equipments and accessories for electroplating plant
   f) Principle of anodizing and its applications
   g) Electroplating on non-conducting materials.

5. Electrical circuits used in refrigeration and air conditioning and water coolers
   5.1 Brief description of vapour compression refrigeration cycle.
   5.2 Description of electrical circuit used in
      a) Refrigerator
      b) Air conditioner
      c) Water cooler

6. Electric drives
   6.1 Advantages of electric drives
   6.2 Characteristics of different mechanical loads
   6.3 Types of motors used in electric drive
   6.4 Electric braking:
      a) Plugging
      b) Rheostatic breaking
      c) Regenerative braking
   6.5 Methods of power transfer by devices like belt drive, gears, pulley
   6.6 Examples of selection of motors for particular loads
   6.7 Applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift
   6.8 Applications of commonly used motors (squirrel cage induction motors, slip ring induction motors, AC series motors).

7. Electric traction
   7.1 Advantages of electric traction
   7.2 Different systems of electric traction, DC and AC system
   7.3 Different accessories for track electrification; such as overhead wires, conductor rail system, current collector-pento graph

7.4 Electrical block diagram of an electric locomotive with description of various equipments and accessories

7.5 Breaking of traction motors

EE602 Utilisation of Electrical Energy (Practical)

1. Study of different types of sources of light and make connections, and to measure intensity of light with lux meter
   - 1.1 Fluorescent lamp
   - 1.2 HP mercury vapour lamp
   - 1.3 HP sodium vapour lamp
   - 1.4 Compact Fluorescent lamp (CFL)
2. Study of induction furnace by visiting a factory and to prepare a report
3. Study of welding equipment and its accessories.
4. Study of the electroplating plant by visiting an industry and preparing a report
5. Study of refrigerator /air conditioner and to prepare a report of its electrical circuit
6. To electroplate a given piece of material
7. To draw load current vs terminal voltage characteristics of a welding transformer with water rheostat load.

+CM-501 **INDUSTRIAL ENGINEERING & MANAGEMENT**

L	T	P
4	-	-

RATIONALE

Diploma holders in mechanical engineering are responsible for controlling production and quality of the product on the shop floor as well as be responsible for production, planning and control. He is also required to supervise erection, installation and maintenance of equipment including material handling and undertake work study for better utilization of resources. He is also required to lead a team of workers and motivate them towards realization of organizational objectives. For this purpose, knowledge and skills about these topics need to be imparted to them. This subject aims at development of competencies to prepare material. Equipment and production control schedules and maintain required quality levels. In addition, it will also help in developing skills in erection, installation and testing of equipment.

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

DETAILED CONTENTS

1. **Productivity** (5%)

Introduction to productivity, factors affecting productivity, measurement of productivity, causes of low productivity and methods to improve productivity.

2. (35%)

(i) Introduction to Work Study : Definition and scope of work study; Areas of application of work study in industry; Inter-relation between method study and work measurement; Human aspects of work study; Reactions of management and labour to work study; Role of work study in improving productivity

(ii) **Method Study**

Objectives and procedure for Methods analysis; Information collection, recording techniques, Process symbols, charts and diagrams , processing aids; critical examination ; development, installation and maintenance of improved methods.

(iii) **Motion Economy and Analysis**

Principles of motion economy; Motion analysis; Micro-motion and Memo-motion study; Simo-charts; Normal work area and design of work places; Basic parameters and principles of work design & Ergonomics.

(iv) **Work Measurement**

Objectives; work measurement techniques, stop watch time study; principle, equipment used and procedure; systems of performance rating; calculation of basic times; various allowances; calculation of standard time, work sampling and predetermined Motion time systems (PMTS) and their comparative study; standard data and its usage; application of engineered time standards, work sampling

3 **(10%)**

(i) **Job Evaluation**

Definition of job, task position and skill, job analysis, data source, job evaluation methods – ranking method, grade description method, point system and factor comparison method, hybrid system.

Wage curve, establishing pay rates for job grades, community and industry wage surveys, components of total remuneration.

(ii) **Incentive Schemes**

Introduction, wage payment for direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour, merit rating

4. **Principles of Management** (5%)

Management, different functions of management: planning, organizing, coordination and control, Structure of an industrial organization, Functions of different departments, Relationship between individual departments

5. **Personnel Management** **(25%)**

(i) **Human and Industrial Relations**

Human relations and performance in organization, Understand self and others for effective behavior, Interpersonal relationship, Behaviour modification techniques, Industrial relations and disputes, Relations with subordinates, peers and superiors, Characteristics of group behaviour and trade unionism, Mob psychology, Grievance, Handling of grievances, Agitations, strikes, Lockouts, Picketing and Gherao, Labour welfare, Workers participation in management

(ii) **Labour, Industrial and Tax Laws**

a. Importance and necessity of industrial legislation
b. Types of labour laws and disputes
c. Brief description of the following Acts: The Factory Act 1948, Payment of Wages Act 1936, Minimum Wages Act 1948, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Employee state insurance Act 1948, Provident Fund Act
d. Various types of Taxes – Production Tax, Local Tax, Sales Tax, Excise Duty, Income Tax.
e. Labour Welfare Schemes

6. (i) **Leadership** **(15%)**eed

for leadership, Functions of a leader, Factors to be considered for accomplishing effective leadership, Manager as a leader

(ii) **Motivation**

Factors determining motivation, Characteristics of motivation, Methods for improving motivation, Incentives, pay promotion, rewards, Job satisfaction and job enrichment.

(iii) **Professional Ethics**

Concept of ethics, Concept of professionalisms, Need for professional ethics, Code of professional ethics, typical problems of professional engineers, Professional bodies and their role

7. **Environmental Engineering, Entrepreneurship** (5%)

(i) Ecology
(ii) Factors causing pollution
(iii) Effects of pollution on Human health

(iv) Air pollution and control act
(v) Water pollution and control act
(vi) Concept & need of entrepreneurship, successful entrepreneurship, source of finance.

EE604 Major Project

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-	-	8

RATIONALE

The Industry/practice based project work is intended to place students in actual work situations for the stipulated period with a view to:

i) Develop understanding regarding the nature of activities, size and scale of operations and environment in which students are going to work after completing the courses of study.

ii) Understand and conceptualise the subject based knowledge given in the class room in the context of its application of work places.

iii) Have first hand experience and develop confidence among the students to enable them to use and apply polytechnic based knowledge and skills to solve practical problems the world of work.

iv) Develop interpersonal relationship, communication skills and positive attitudes.

v) Project related with Design/simulation/Fabrication and other allied area of Electrical Engineerisng

Electrical Machines and Equipments :

Constructions of small transformer (100 VA)
Constructions of phase sequence indicator
Hot air drier
Simple loop generator
Automatic curtain operator
Construction of Automatic Star Delta Starter
Construction of Automatic Water level control
Balancing load as an indoor transformer
Construction of Chokes for fluorescent tubes
Design and construction of fan regulators (inductance type)
Design and construction of fan regulators (Resistance type)
Design and construction of loading rheostats
Design and construction of Desert coolers
Fabrication of electric motor
Rewinding of motors upto 5 HP
Design and construction of Geyser
Electroplating of small domestic gadgets
Erection/installation and commissioning of rotating electrical machine
Fault detection and repair of electrical/electronic instruments
Design and assembly of contractor control circuit for various applications

Electrical Power :

Drawing, estimating and costing of electrical installation of the institution from supplier's point to the institution sub circuit distribution board drawing, estimating and costing of electric, installation of a workshop having a given number of electrically operated appliances machines.
To lay underground distribution cable for small colony from main distribution pole.

To erect a 5 pole overhead line for a small distance for distribution of given electrical energy. To energise it and prepare list of material and cost required.

To provide a service connection to a consumers premises for domestic purpose

To survey the load of given area in village, small colony, calculate the effective load and find out the sizes of the cables conductors for the proposed distribution systems.

Designing of Light and Fan wiring installation for a institutional/commercial building

Augumentation of nearby 0pole mounted sub stations

To carry out energy audit of given organization and to suggest ways and means to limit the energy bill

Electronics :

Fabrication of :

Voltage Stabilizer
Emergency light using SCR
Power amplifier
Low cost intercom for home
Analog computer
Regulated power supply (±12 V and ±6 V) using 7812, 7912 and 7806, 7809
Automatic battery charger using SCR
Battery operated tube light
Solid state fan regulator
Burglar Alarm
Hearing aid
Automatic street light/dressing table light
Mosquito Repeller
Inverter circuit 500 watt.

Fabrication and Testing of :

Inverter/Emergency light circuit using power transistors
SCR based automatic battery charger
SCR operated illumination controller
SCR operated automatic water level controller
SCR based speed controller for DC shunt motor
Three phase full wave rectifier using power diodes
Timer circuit using 555-IC
SCR controlled rectifier circuit

Speed control circuit of DC shunt motor using SCR
Inverting and non-inverting amplifiers using AMP (741)
Comparator circuits using OP AMP (741)

NOTE : The evaluation of the project should be based on end product and process adopted by students in execution of this.

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