

CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT, ODISHA
TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES

DISCIPLINE: ELECTRICAL ENGINEERING						SEMESTER: 6 TH						
SL NO	SUBJECT CODE	SUBJECT	PERIODS			EVALUATION SCHEME						
			L	T	P	INTERNAL EXAM			END SEM EXAM	TERM WORK	PRACTICAL EXAM	TOTAL MARKS
						TA	CT	Total				
THEORY												
1.	DCEM6101	ENTERPRENEURSHIP AND MANAGEMENT	5	0	0	10	20	30	70			100
2.	DESP6102	SWITCH GEAR AND PROTECTIVE DEVICES	4	1	0	10	20	30	70			100
3.	DEUE6103	UTILIZATION OF ELECTRICAL ENERGY AND TRACTION	4	0	0	10	20	30	70			100
4.	DEEI6104	ELECTRICAL INSTALLATION AND ESTIMATING	5	0	0	10	20	30	70			100
5.	DECS6105	CONTROL SYSTEM ENGINEERING	4	0	0	10	20	30	70			100
		A. TESTING AND MAINTENANCE OF ELECTRICAL MACHINE										
		B. MICRO-CONTROLLER AND PLC										
		C. CONTROL SYSTEM ENGINEERING										
		D. HVDC TRANSMISSION										
PRACTICAL/TERM WORK												
6.	DEEW6203	ELECTRICAL WORKS PRACTICE	0	0	6					50	50	100
7.	DEEP6201	ELECTRICAL PROJECT & SEMINAR	0	0	4					50	50	100
8.	DESM6202	SIMULATION PRACTICE ON MATLAB	0	0	4					25	25	50
9.		LIBRARY STUDY	-	-	2					--	-	-
GRAND TOTAL			22	1	16	50	100	150	350	125	125	750
Total Contact hours per week: 39												
Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assessment, CT- Class test												
Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50%												

ENTREPRENEURSHIP & MANAGEMENT

(Code: DCEM6101)

Period/Week: 05
Total Periods: 75

Total Marks: 100
Theory End Exams: 70; CT (20) +IA (10)

(COMMON TO ALL BRANCHES OF ENGG EXCEPT CIVIL/ CSE/ IT)

OBJECTIVES:

On completion of the course, students will be able to :

1. Understand the concept of different forms of organization including MSME and various managerial functions.
2. Understand Entrepreneurship and choose it as a career option after study.
3. Learn about the basic financial accounting and cost control.
4. Know different areas of management relating to stores and purchase, finance, production, sales and marketing and human resources in an organization.
5. Learn about various reasons of industrial sickness and its remedial measures.
6. Have a comprehensive idea on important legislations relating to employment in Factory.

SYLLABUS

- 1. Concept of Organization & Enterprise Management: 12 periods**
 - 1.1. Meaning, features and components of Business
 - 1.2. Different forms of Business Organizations with features
 - 1.3. Meaning, definitions and importance of management
 - 1.4. Difference between Management & Administration
 - 1.5. Functions of management- Planning, Organizing, Staffing, Directing (including Motivation, Leadership & Communication), Coordinating and Controlling.
 - 1.6. Principles of Scientific Management.

- 2. Entrepreneurship & Management of MSME: 12 periods**
 - 2.1. Meaning & Need of Entrepreneurship
 - 2.2. Qualities of an Entrepreneur
 - 2.3. Relevance of Entrepreneurship of Socio-economic gain (Generating national wealth, creating wage & self employment, developing MSME enterprises, Optimizing human and national resources, building enterprising personalities and society
 - 2.4. Micro, Small and Medium Enterprises. (investment limits of MSME)
 - 2.5. Project Report- PPR & DPR. (Preparation of a PPR)
 - 2.6. Incentives available to MSME as per the latest IPR
 - 2.7. Role of DIC, OSFC, OSIC, IDCO, SIDBI, IPICOL and Commercial Banks in the context of MSME.

3. **Financial Accounting & Cost Control:** **12 periods**
 - 3.1. Double- entry System of Book –keeping and types of accounts
 - 3.2. Journal, Ledger, Cash Book (different types), Trial balance
 - 3.3. Components of Final Accounts- Trading A/c, Profit & Loss A/c and Balance Sheet
 - 3.4. Elements of Cost and Preparation of Cost Sheet
 - 3.5. Break-even Analysis

4. **Financial Management:** **04 periods**
 - 4.1. Meaning & Importance
 - 4.2. Finance Functions
 - 4.3. Types of Capital- Fixed & Working Capital
 - 4.4. Components of Working Capital, Working Capital Cycle

5. **Stores & Purchase Management:** **05 periods**
 - 5.1. Inventory Control : Importance & Techniques
 - 5.2. Purchase management-Principles & Procedures
 - 5.3. Important Store Records (Bin Card, Stores Ledger & GRN)

6. **Production Management:** **04 periods**
 - 6.1. Production & Productivity
 - 6.2. Production , Planning & Control- (meaning & steps)

7. **Sales & Marketing Management:** **08 periods**
 - 7.1. Sales & Marketing Management- Meaning & Importance
 - 7.2. Selling Methods
 - 7.3. Product Policy- (Branding, Packaging, Labeling)
 - 7.4. Product-mix, Pricing methods and Sales Promotion including its techniques.
 - 7.5. Advertising & its media

8. **Human Resource Management:** **06 periods**
 - 8.1. Need & Importance
 - 8.2. Recruitment & its sources
 - 8.3. Selection- Methods
 - 8.4. Training- Need, & Methods
 - 8.5. Need of Performance Appraisal

9. **Industrial Sickness:** **04 periods**
 - 9.1. Meaning & Symptoms of Sickness
 - 9.2. Causes of Industrial Sickness
 - 9.3. Remedial measures of Sickness

10. Industrial Legislation:

08 periods

- 10.1. Major Provisions of Factories Act relating to Health, Welfare, Safety, Accidents, Hours of Work, employment of Women
- 10.2. Duties and Power of Factory Inspector
- 10.3. Major Provisions of Employee's Compensation Act.

Books Recommended

1. Industrial Engineering & Management : O.P.Khanna
2. Entrepreneurship for Engineers : B.Badhai
3. Principles & Practice of Management : L.M.Prasad
4. Industrial Engineering & Management: Banga & Sharma
5. Mercantile Law: N.D.Kapoor
6. Industrial Engineering & production Management: M.Mahajan
7. Industrial Policy Resolution (latest)

SWITCH GEAR AND PROTECTIVE DEVICES

Name of the Course: Diploma in Electrical Engineering

Course code:	DESP6102	Semester	6 th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

Switch gear and protection plays an important role in the protection of electrical power system. Since the demand of electrical power is increasing the job of generation, transmission & distribution of electrical energy is becoming very completed. To maintain the energy supply to the consumer switching producer with protection is to be maintained moreover new models of switch gear and protection circuits are also being developed. The use of interconnection bus with National power grid type of switch gear and protecting devices need to be trained in proper manners. In the subject information on above context has been included so that the updated knowledge can be given to the students of Diploma in Electrical Engineering.

B. OBJECTIVE:

To acquire the knowledge of :

- a) The basic principles of protection of alternator transformer and feeders.
- b) Fuse and Circuit breaker.
- c) Protective Relay.
- d) Lighting Arrestor.
- e) Calculation of symmetrical fault current.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction To Switchgear	6
2	Fault Calculation	10
3	Fuses	5
4	Circuit Breakers	10
5	Protective Relays	10
6	Protection Of Electrical Power Equipment And Lines	6
7	Protection Against Over Voltage And Lighting	7
8	Static Relay	6
Total:		60

D. COURSE CONTENTS

1.	INTRODUCTION TO SWITCHGEAR	06
	1.1 Essential Features of switchgear.	
	1.2 Switchgear Equipment.	
	1.3 Bus-Bar Arrangement.	
	1.4 Switchgear Accommodation.	
	1.5 Short Circuit.	
	1.6 Short circuit.	
	1.7 Faults in a power system.	
2.	FAULT CALCULATION	10
	2.1 Symmetrical faults on 3-phase system.	
	2.2 Limitation of fault current.	
	2.3 Percentage Reactance.	
	2.4 Percentage Reactance and Base KVA.	
	2.5 Short – circuit KVA.	

- 2.6 Reactor control of short circuit currents.
- 2.7 Location of reactors.
- 2.8 Steps for symmetrical Fault calculations.
- 2.9 Solve numerical problems on symmetrical fault.

3. FUSES

05

- 3.1 Desirable characteristics of fuse element.
- 3.2 Fuse Element materials.
- 3.3 Types of Fuses and important terms used for fuses.
- 3.4 Low and High voltage fuses.
- 3.5 Current carrying capacity of fuse element.
- 3.6 Difference Between a Fuse and Circuit Breaker.

4. CIRCUIT BREAKERS

10

- 4.1 Definition and principle of Circuit Breaker.
- 4.2 Arc phenomenon and principle of Arc Extinction.
- 4.3 Methods of Arc Extinction.
- 4.4 Definitions of Arc voltage, Re-striking voltage and Recovery voltage.
- 4.5 Classification of circuit Breakers.
- 4.6 Oil circuit Breaker and its classification.
- 4.7 Plain brake oil circuit breaker.
- 4.8 Arc control oil circuit breaker.
- 4.9 Low oil circuit breaker.
- 4.10 Maintenance of oil circuit breaker.
- 4.11 Air-Blast circuit breaker and its classification.
- 4.12 Sulphur Hexa-fluoride (SF₆) circuit breaker.
- 4.13 Vacuum circuit breakers.
- 4.14 Switchgear component.
- 4.15 Problems of circuit interruption.
- 4.16 Resistance switching.
- 4.17 Circuit Breaker Rating.

5. PROTECTIVE RELAYS

10

- 5.1 Definition of Protective Relay.
- 5.2 Fundamental requirement of protective relay.
- 5.3 Basic Relay operation
 - a) Electromagnetic Attraction type
 - b) Induction type
- 5.4 Definition of following important terms
- 5.5 Definition of following important terms.
 - a) Pick-up current.
 - b) Current setting.
 - c) Plug setting Multiplier.
 - d) Time setting Multiplier.
- 5.6 Classification of functional relays
- 5.7 Induction type over current relay (Non-directional)
- 5.8 Induction type directional power relay.
- 5.9 Induction type directional over current relay.
- 5.10 Differential relay
 - a) Current differential relay
 - b) Voltage balance differential relay.

5.11 Types of protection

- 6. PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES** **06**
- 6.1 Protection of alternator.
 - 6.2 Differential protection of alternators.
 - 6.3 Balanced earth fault protection.
 - 6.4 Protection systems for transformer.
 - 6.5 Buchholz relay.
 - 6.6 Protection of Bus bar.
 - 6.7 Protection of Transmission line.
 - 6.8 Different pilot wire protection (Merz-price voltage Balance system)
 - 6.9 Explain protection of feeder by over current and earth fault relay.
- 7. PROTECTION AGAINST OVER VOLTAGE AND LIGHTING** **07**
- 7.1 Voltage surge and causes of over voltage.
 - 7.2 Internal cause of over voltage.
 - 7.3 External cause of over voltage (lighting)
 - 7.4 Mechanism of lightning discharge.
 - 7.5 Types of lightning strokes.
 - 7.6 Harmful effect of lightning.
 - 7.7 Lightning arresters.
 - 7.8 Type of lightning Arresters.
 - a) Rod-gap lightning arrester.
 - b) Horn-gap arrester.
 - c) Valve type arrester.
 - 7.9 Surge Absorber
- 8. STATIC RELAY** **06**
- 8.1 Advantage of static relay.
 - 8.2 Instantaneous over current relay.
 - 8.3 Principle of IDMT relay.

Learning Resources:

Sl.No	Name of Authors	Title of the Book	
1	V. K. Mehta	Principle of power system	S Chand
2	Soni, Gupta and Bhatnagar	Electrical power	Dhanpat Rai & Sons
3	Bhuvanesh Oza	Power system protection & switch gear	TMH
4	S. L. Uppal	Electrical Power	
5	Raghuraman	Protection and Switchgear	SCITECH

UTILIZATION OF ELECTRICAL ENERGY AND TRACTION

Name of the Course: Diploma in Electrical Engineering

Course code:	DEUE6103	Semester	6 th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	--	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

There is great demand for utilization of electrical power in various fields in the form of power for electrolysis and illumination, electrical heating, electrical welding, electrical traction and for electrical drives. Hence these aspects are taken care of in the subject of utilization of electrical energy and traction to give exposure of the student in the senior 6th Semester level.

B. OBJECTIVE:

1. To acquire knowledge of principle of ionic dissociation and electrolysis and loss involving in the process, usage of this process.
2. To compare the advantages of the electrical heating over others and to acquire knowledge of types of electrical heating as employed in the electrical oven, induction furnaces and arc furnaces and dielectrically ovens.
3. To acquire knowledge of principle of arc welding and resistant welding, their types and single and multi operator type are welding plants.
4. To define various terms used in illumination engineering to design lighting schemes with specific attention to laws of illumination to explain the working and construction and use of fluorescent lamp, SV lamp, H.P. MV and Neon lamps.
5. To classify various types of industrial drives and to choose the right type of drive considering their starting and running characteristics.
6. To classify various methods of traction and traction motor and type of control and types of breaking.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Electrolytic Process	08
2.	Electrical Heating	08
3.	Principles of Arc Welding	08
4.	Illumination	12
5.	Industrial Drives	10
6.	Electric Traction	14
	Total	60

D. COURSE CONTENTS

- | | | | |
|----|-----------------------------|---|-----------|
| 1. | ELECTROLYTIC PROCESS | | 08 |
| | 1.1 | Definition and Basic principle of Electro Deposition. | |
| | 1.2 | Important terms regarding electrolysis. | |
| | 1.3 | Faradays Laws of Electrolysis. | |
| | 1.4 | Definitions of current efficiency, Energy efficiency. | |

- 1.5 Principle of Electro Deposition.
 - 1.6 Factors affecting the amount of Electro Deposition.
 - 1.7 Factors governing the electro deposition.
 - 1.8 State simple example of extraction of metals.
 - 1.9 Application of Electrolysis.
- 2. ELECTRICAL HEATING** **08**
- 2.1. Advantages of electrical heating.
 - 2.2. Explain mode of heat transfer and Stephen's Law.
 - 2.3. Discuss principle of Resistance heating.
 - 2.3.1 Direct Resistance heating.
 - 2.3.2 Indirect Resistance heating.
 - 2.4. Explain working principle of direct arc furnace and indirect arc furnace.
 - 2.5. Principle of Induction heating.
 - 2.6. Working principle of direct core type, vertical core type and indirect core type Induction furnace.
 - 2.7. Principle of coreless induction furnace and skin effect.
 - 2.8. Principle of dielectric heating and its application.
 - 2.9. Principle of Microwave heating and its application.
- 3. PRINCIPLES OF ARC WELDING** **08**
- 3.1 Explain principle of arc welding.
 - 3.2 Discuss D. C. & A. C. arc phenomena
 - 3.3 D.C. & A. C. arc welding plants of single and multi-operation type.
 - 3.4 Types of arc welding.
 - 3.5 Explain principles of resistance welding.
 - 3.6 Descriptive study of different resistance welding methods.
- 4. ILLUMINATION** **12**
- 4.1 Nature of Radiation and its spectrum.
 - 4.2 Terms used in Illuminations.
 - i. Luminous intensity
 - ii. Lumen
 - iii. Intensity of illumination
 - iv. MHCP
 - v. MSCP
 - vi. MHSCP
 - vii. Brightness
 - viii. Solid angle
 - ix. Luminous efficiency
 - 4.3 Explain the inverse square law and the cosine law.
 - 4.4 Explain polar curves.
 - 4.5 Describe light distribution and control. Explain related definitions like maintenance factor and depreciation factors.
 - 4.6 Design simple lighting schemes and depreciation factor.
 - 4.7 Constructional feature and working of Filament lamps, effect of variation of voltage on working of filament lamps.
 - 4.8 Explain Discharge lamps.
 - 4.9 State Basic idea about excitation in gas discharge lamps.
 - 4.10 State constructional features and operation of: - Fluorescent lamp. (PL and PLL Lamps)

- 4 . 11 Sodium vapor lamps.
- 4 . 12 High pressure mercury vapour lamps.
- 4 . 13 Neon sign lamps.
- 4 . 14 High lumen output & low consumption fluorescent lamps.

5. INDUSTRIAL DRIVES 10

- 5 . 1 State group and individual drive.
- 5 . 2 Method of choice of electric drives.
- 5 . 3 Explain starting and running characteristics of DC and AC motor.
- 5 . 4 State Application of :
 - 5.4.1 DC motor
 - 5.4.2 3 phase induction motor
 - 5.4.3 3 phase synchronous motors.
 - 5.4.4 Single phase induction, series motor, universal motor and repulsion motor.

6. ELECTRIC TRACTION 14

- 6 . 1. Explain system of traction.
- 6 . 2. System of Track electrification.
- 6 . 3. Running Characteristics of DC and AC traction motor.
- 6 . 4. Explain control of motor
 - 6.4.1 Tapped field control
 - 6.4.2 Rheostatic control
 - 6.4.3 Series parallel control
 - 6.4.4 Metadyne control
- 6 . 5. Explain Braking of the following types.
 - 6.5.1 Regenerative Braking
 - 6.5.2 Braking with 1-phase series motor
 - 6.5.3 Magnetic Braking

Learning Resources:

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	G. C. Garg	Utilization of Electrical Energy by Traction	Khanna
2	E. I. Taylor	Utilization of Electrical Energy	
3	Soni Gupta Bhatnagar	A Text book on Power system Engineering	Dhanpat Rai & Sons

ELECTRICAL INSTALLATION AND ESTIMATING

Name of the Course: Diploma in Electrical Engineering

Course code:	DEEI6104	Semester	6 th
Total Period:	75	Examination	3 hrs
Theory periods:	5P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

Prior to implementation of a project in the power transmission and distribution sectors, a material estimate is required in various stages: like i) transmission line construction ii) distribution line construction iii) erection of domestic installation iv) service connection to industrial installation etc. In estimating, calculation of quantity of material is estimated by the estimator. This subject 'Electrical Installation and Estimating' is meant for learning the estimation process by the final semester students

B. OBJECTIVE:

1. To write down detailed specification and numbers required of different materials.
2. To determine the size and material of conductor and cable from electrical and mechanical consideration. As such to prepare a detailed list of materials with complete specifications.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Internal wiring	08
2.	IE rules and standards	06
3.	Estimate of material for domestic wiring	07
4.	Estimate of material for workshop wiring	07
5.	Estimate of material for single phase service connection	08
6.	Estimate of material for service connection to factory	08
7.	Estimate of materials for L. T. Distribution	09
8.	Estimate of materials for H. T. Distribution	11
9.	Material estimate for substation	11
	Total	75

D. COURSE CONTENTS

1. INDIAN ELECTRICITY RULES

- 1.1 Definitions, Ampere, Apparatus, Accessible, Bare, cablew, circuit, circuit breaker, conductor voltage (low, medium, high, EH), live, dead, cut-out, conduit, system, danger, Installation, earthing system, span, volt, switch gear, etc.
- 1.2 General safety precautions, rule 29, 30, 31, 32, 33, 34, 35, 36, 40, 41, 43, 44, 45, 46.
- 1.3 General conditions relating to supply and use of energy : rule 47, 48, 49, 50, 51, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70.
- 1.4 OH lines : Rule 74, 75, 76, 77, 78, 79, 80, 86, 87, 88, 89, 90, 91

2. ELECTRICAL INSTALLATIONS

- 2.1 Electrical installations, domestics, industrial, Wiring System, Internal distribution of Electrical Energy. Methods of wiring, systems of wiring, wire and cable, conductor materials used in cables, insulating materials mechanical protection. Types of cables used in internal wiring, multi-stranded cables, voltage grinding of cables, general specifications of cables.
- 2.2 ACCESSORIES: Main switch and distribution boards, conduits, conduit accessories and fittings, lighting accessories and fittings, fuses, important definitions, determination of size of fuse – wire, fuse units. Earthing conductor, earthing, IS specifications regarding earthing of electrical installations, points to be earthed. Determination of size of earth wire and earth plate for domestic and industrial installations. Material required for GI pipe earthing.
- 2.3 LIGHTING SCHEME: Aspects of good lighting services. Types of lighting schemes, design of lighting schemes, factory lighting, public lighting installations, street lighting, general rules for wiring, determination of number of points (light, fan, socket, outlets), determination of total load, determination of Number of sub-circuits.

3. INTERNAL WIRING

- 3.1 Type of internal wiring, cleat wiring, CTS wiring, wooden casing capping, metal sheathed wiring, conduit wiring, their advantage and disadvantages comparison and applications.
- 3.2 Prepare one estimate of materials required for CTS wiring for small domestic installation of one room and one verandah within 25 m² with given light, fan & plug points.
- 3.3 Prepare one estimate of materials required for conduit wiring for small domestic installation of one room and one verandha within 25 m² with given light, fan & plug points.
- 3.4 Prepare one estimate of materials required for concealed wiring for domestic installation of two rooms and one latrine, bath, kitchen & verandah within 80m² with given light, fan & plug points.
- 3.5 Prepare one estimate of materials required for erection of conduct wiring to a small workshop installation about 30m² and load within 10 KW.

4. OVER HEAD INSTALLATION

- 4.1 Main components of overhead lines, line supports, factors Governing Height of pole, conductor materials, determination of size of conductor for overhead transmission line, cross arms, pole brackets and clamps, guys and stays, conductors configurations, spacing and clearances, span lengths, overhead line insulators, types of insulators, lighting arresters, danger plates, anti-climbing devices, bird guards, beads of jumpers, jumpers, tee-offs, guarding of overhead lines.
- 4.2 Prepare an estimate of materials required for LT distribution line within load of 100 KW maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consideration using ACSR.

- 4.3. Prepare an estimate of materials required for LT distribution line within load of 100 KW maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consideration using ACSR.
- 4.4. Prepare an estimate of materials required for HT distribution line (11 KV) within 2 km and load of 2000 KVA maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consideration using ACSR.

5. OVER HEAD SERVICE LINES

10

- 5.1 Components of service lines, service line (cables and conductors), bearer wire, lacing rod. Ariel fuse, service support, energy box and meters etc.
- 5.2 Prepare and estimate for providing single phase supply of load of 5 KW (light, fan, socket) to a single stored residential building.
- 5.3 Prepare and estimate for providing single phase supply load of 3KW to each floor of a double stored building having separate energy meter.
- 5.4 Prepare one estimate of materials required for service connection to a factory building with load within 15 KW using insulated wire.
- 5.5 Prepare one estimate of materials required for service connection to a factory building with load within 15 KW using bare conductor and insulated wire combined.

6. ESTIMATING FOR DISTRIBUTION SUBSTATIONS

06

- 6.1 Prepare one materials estimate for following types of transformer substations.
 - 6.1.1 Pole mounted substation
 - 6.1.2 Plinth Mounted substation.

Learning Resources:

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	Surjit Singh	Electrical Installation and Estimating	Dhanpatrai and sons
2	J B Gupta	A course in Electrical Installation, Estimating and costing	S K Kataria and Sons

TESTING AND MAINTENANCE OF ELECTRICAL MACHINE**(Elective- A)**

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6 th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

This subject intends to be acquainted with application level technology, normally adopted in Industries, commercial, public utility departments such as Electrical transmission and distribution, Irrigation, Water supply etc. The knowledge in this subject will make the readers able for inspection, testing, installation and commissioning of electrical machines as per IS standards. This will help him to initiate total productive maintenance.

B. OBJECTIVE:

1. To acquire knowledge on safety measures and precautions.
2. Testing of DC and AC rotating machines and transformers.
3. Identify common troubles in Electrical machines and switch gear.
4. Plan and carryout routine and preventive maintenance.
5. Install LV switch gear and maintain it.
6. Ascertain the condition of insulation and varnishing. (if necessary)
7. Initiate total productive maintenance.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Installation, Commissioning and Testing of Machine	15
2.	Installation, Commissioning and Testing of Transformer	15
3.	Installation, Commissioning & Testing of Sub-station.	15
4.	Maintenance	15
	Total	60

D. COURSE CONTENTS**1. Installation, Commissioning and Testing of Machine:**

- 1.1. Inspection of arrival of machine and inspection procedure before its installation.
- 1.2. Generalized procedure of installation of Electrical machines.
- 1.3. Electric wiring for motors and switch gears.
- 1.4. General requirement for Electric Installation according to Indian Electricity rules.
- 1.5. Necessity of starters and relays for both DC and AC machines.

1.6. Testing before giving supply and testing report.

2. Installation, Commissioning and Testing of Transformer:

- 2.1 Basic idea on dispatch, inspection, storage and handling of transformer.
- 2.2 Civil construction feature regarding connection like ventilation, noise level, space for free movement.
- 2.3 Foundation and drainage of oil.
- 2.4 Cabling and cable box for transformer.
- 2.5 Provision for fire protection.
- 2.6 Provision for bushing support location of switch gear.
- 2.7 Steps for commissioning fitting of all accessories.
- 2.8 Filling of oil, drying out.
- 2.9 Charging the breather with fresh silica gel.
- 2.10 Cleaning of bushing, fixing of conductor & cables, earthing of tank and cover, neutral earthing.
- 2.11 Fixing of protection circuits and setting of relays.

3. Installation, Commissioning & Testing of Sub-station.

- 3.1 Design and planning of indoor substation.
- 3.2 General requirement of layout of indoor substation with key diagram.
- 3.3 Consideration of safe operation of substation
- 3.4 Installation of outdoor substation:
 - 3.4.1 Selection of site, transport & receipt of transformer, checking of insulation resistance of the winding, testing of transformer oil, protection fittings, construction of mounting, earthing arrangement and final commissioning.
- 3.5 Testing and commissioning of substation.
 - 3.5.1. Installation of control and relay panels.
 - 3.5.2. Preliminary preparation.
 - 3.5.3. Sequence card for erection of switch gear equipments.
 - 3.5.4. Location of place
 - 3.5.5. Unpacking
 - 3.5.6. Foundation
 - 3.5.7. Erection
 - 3.5.8. Relays
- 3.6 Bus-bar earthing connection, Earthing.
 - 3.6.1. Connection to main cable.
 - 3.6.2. Safety precaution
- 3.7 Installation of outdoor circuit breaker:
 - 3.7.1. Receipt and storage.
 - 3.7.2. Civil works.
 - 3.7.3. Various steps for installation.
- 3.8 Pre-commissioning tests.

4. Maintenance:

- 4.1 Fundamental of maintenance.
- 4.2 Preventive maintenance and planning.
[Daily, Weekly, Monthly, Half-yearly and Yearly maintenance.]

- 4.3 Advantages of Preventive maintenance:
- 4.4 Breakdown maintenance: List of tools / instruments and materials used for maintenance.
- 4.5 Making or Preparing Maintenance schedule of DC machines, Induction machines, Synchronous machines, Transformer, Transmission line, Distribution lines, Underground cables, Circuit breakers, Switch gear and protective relays and substations, SF-6 circuit breakers, Batteries in substation.

Learning Resources:

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	Tarlok Singh	Installation Commissioning & Maintenance of Electrical Equipments	S. K. Kataria & Sons, second edition
2	S Rao	Testing Commissioning Operation and Maintenance of Electrical Equipments	Khanna Publisher
3	Er. R. N. Sahoo	Hand book of Inspection, for all type of Electrical Instruments	Orissa Power Generation consultants and services

MICRO-CONTROLLER AND PLC**(Elective- B)**

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6 th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

The microprocessor has been with us for some Twenty Five years but it has limited applications. More complicated hardware, limited use with computer and more cost restricted its market value. On the other hand micro controller is a true computer on a small chip, simpler in hardware, millions of general purpose application are carried out with this device and capable of processing several functions depending on the programming. So now a day, use of micro controller is increasing in industries and therefore, it is necessary for the students to study this course to get a hold of themselves for industrial applications.

B. OBJECTIVE:

Study of this subject develops the ability of the student on:

- 1 Study design and maintain the micro controller circuits
- 2 Programme for micro controllers for different operations and applications in industries.
- 3 Develop different use of micro controller.
- 4 Acquire knowledge about various components of PLC.
- 5 Acquire knowledge about programming of PLC.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Introduction to microcontroller and micro processor	06
2.	Intel 8051 microcontroller.	06
3.	Instructions and programming	10
4.	8051 Interrupts and serial communication	07
5.	ATMAL micro controller	06
6.	Application of MCS-51 & ATMEL -8951	07
7.	PIC micro controller	06
8.	Programmable Logic Controller	06
9.	PLC programming	06
	Total	60

D. COURSE CONTENTS

1. INTRODUCTION TO MICRO CONTROLLERS AND MICROPROCESSORS

- 1.1 Conception of microcontroller and microprocessor.
- 1.2 History of Microcontroller.
- 1.3 Embedded vers external memory devices.
- 1.4 8 bit and 16 bit microcontroller.
- 1.5 CISC and R.I & C processor.
- 1.6 Harvard and Vonneumann Architecture.
- 1.7 MSC-51 and 89Cxx51 microcontrollers.
- 1.8 PIC microcontrollers.

2. 8051 MICRO CONTROLLER

- 2.1 MCS-51 Architecture with description of each block.
- 2.2 Registers in MCS-51
- 2.3 MCS-51 pin description and connections.
- 2.4 MCS-51 parallel port and memory organisation

3. INSTRUCTIONS AND PROGRAMMING

- 3.1 MCS-51 Instructions or set and its grouping.
- 3.2 MCS-51-addressing modes.
- 3.3 Simple programming examples using different branch instructions.
- 3.4 Programme with Branching Instructions.
- 3.5 Programme using stack pointer.
- 3.6 Programming tools

4. MCS-51 INTERRUPT, TIMER/COUNTER AND SERIAL COMMUNICATION.

- 4.1 Interrupts.
- 4.2 Timer and counter.
- 4.3 Serial communication.

5. ATMEL MICROCONTROLLER

- 5.1 Architecture of TMEL 89C51 and 89 C 2051.
- 5.2 Pin description of 89C51 and 89C2051.
- 5.3 Use of flash memory.
- 5.4 Power saving option.

6. APPLICATION OF MCS-51, ATMEL-89051 AND 89C2051

- 6.1 Square wave generator.
- 6.2 Pulse generation and pulse width modulation.
- 6.3 Sinc wave generator.
- 6.4 Frequency counter.

7. PIC MICROCONTROLLERS

- 7.1 PIC 166X/7X architecture.
- 7.2 Pin configuration and description of 16C6X/7x
- 7.3 PIC Reset action.
- 7.4 PIC memory organization.
- 7.5 PIC Addressing mode and I/O port.
- 7.6 PIC Timer.

8. PROGRAMMABLE LOGIC CONTROLLER

- 8.1 Introduction, Definition and advantage.
- 8.2 Parts of PLC.
- 8.3 Principle of operation and modifying it.
- 8.4 Comparison between PLC and computer.
- 8.5 PIC size and application.
- 8.6 PIC I/O section and discrete I/O mode.
- 8.7 Special I/O module and I/O specification.
- 8.8 PIC CPU.
- 8.9 PIC memory organization and types.
- 8.10 Programming device.
- 8.11 PLC programming.

9. PLC PROGRAMMING

- 9.1 Hardwired Device Verses programmed logic.
- 9.2 PIC programming language.
- 9.3 Instruction addressing.
- 9.4 Branch Instruction.
- 9.5 Internal Relay Instruction.
- 9.6 Entering the ladder diagram.
- 9.7 Modes of operation.
- 9.8 Lacking Relay design to control the level of water in storage tank.

Learning Resources:

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1.	Ajaya V. Deshmukh	Microcontroller, Theory and Application	TMH
2.	Frank. D. Petruzella	Programmable logic controllers	TMH
3.	K. J. Ayala	The 8051 Microcontroller Architecture, Programming and Application	

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CONTROL SYSTEM ENGINEERING**(Elective – C)**

Name of the Course: Diploma in Electrical Engineering

Course code:	DECS6105	Semester	6 th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

Automatic control has played a vital role in modern Engineering and Science. It has become an indispensable part of modern manufacturing and industrial process. So knowledge of automatic control system is dreadfully essential on the part of an Engineer. Basic approach to the automatic control system has been given in the subjects, so that students can enhance their knowledge in their future professional carrier.

B. OBJECTIVE:

Study of 'Control System' enhances the ability of the student on:

1. Acquire knowledge about time response analysis of control system.
2. Finding out steady state error and error constants.
3. Acquire knowledge about the analysis of stability in Root locus technique.
4. Learning about frequency response analysis of control system.
5. To use Bode plot and Nyquist plot for judgments about stability of a system.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Signal flow graph	10
2.	Time response of system	12
3.	Analysis of stability	12
4.	Frequency response of system	14
5.	Niquiest plot	12
	Total	60

D. COURSE CONTENTS**1. SIGNAL FLOW GRAPH.**

- 1.1 Review of block diagrams and transfer functions of multivariable systems.
- 1.2 Construction of signal flow graph.
- 1.3 Basic properties of signal flow graph.
- 1.4 Signal flow graph algebra.
- 1.5 Construction of signal flow graph for control system.

2. TIME RESPONSE ANALYSIS.

- 2.1 Time response of control system.
- 2.2 Standard Test signal.
 - 2.2.1. Step signal,
 - 2.2.2. Ramp Signal
 - 2.2.3. Parabolic Signal

- 2.2.4. Impulse Signal
- 2.3 Time Response of first order system with:
 - 2.3.1. Unit step response
 - 2.3.2. Unit impulse response.
- 2.4 Time response of second order system to the unit step input.
 - 2.4.1. Time response specification.
 - 2.4.2. Derivation of expression for rise time, peak time, peak overshoot, settling time and steady state error.
 - 2.4.3. Steady state error and error constants.
- 2.5 Types of control system.[Steady state errors in Type-0, Type-1, Type-2 system]
- 2.6 Effect of adding poles and zero to transfer function.
- 2.7 Response with P, PI, PD and PID controller.
- 3. ANALYSIS OF STABILITY BY ROOT LOCUS TECHNIQUE.**
 - 3.1 Root locus concept.
 - 3.2 Construction of root loci.
 - 3.3 Rules for construction of the root locus.
 - 3.4 Effect of adding poles and zeros to $G(s)$ and $H(s)$.
- 4. FREQUENCY RESPONSE ANALYSIS.**
 - 4.1 Correlation between time response and frequency response.
 - 4.2 Polar plots.
 - 4.3 Bode plots.
 - 4.4 All pass and minimum phase system.
 - 4.5 Computation of Gain margin and phase margin.
 - 4.6 Log magnitude versus phase plot.
 - 4.7 Closed loop frequency response.
- 5. NYQUIST PLOT**
 - 5.1 Principle of argument.
 - 5.2 Nyquist stability criterion.
 - 5.3 Niquist stability criterion applied to inverse polar plot.
 - 5.4 Effect of addition of poles and zeros to $G(S)$ $H(S)$ on the shape of Niquist plot.
 - 5.5 Assessment of relative stability.
 - 5.6 Constant M and N circle
 - 5.7 Nicholas chart.

Learning Resources:

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1.	A. Ananda Kumar	Control System	PHI
2.	K. Padmanavan	Control System	IK
3.	I. J. Nagarath, M. Gopal	Control system Engineering	WEN
4.	A Natrajan,Ramesh Babu	Control system Engineering	Scientific
5.	D N Manik	Control Systems	Cengage

HVDC TRANSMISSION**(Elective – D)**

Name of the Course: Diploma in Electrical Engineering

Course code:	DEES6105	Semester	6 th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

Modern DC power transmission is relatively a new technology. The advent of Thyristor and related technological improvements is responsible for acceleration of the growth of HVDC system. The objective for study of this subject is to make the final semester electrical students to manage the knowledge level with modern trend of electric transmission with minimum transmission loss.

B. OBJECTIVE:

Study of the subject leads the student to know about:

1. Difference between AC and DC transmission
2. Types of DC transmission
3. Recent trends of technology of power transmission.
4. Control and protection of DC transmission system
5. Control of power flow

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	DC Power Transmission Technology	10
2.	Thyristor Valve	10
3.	Converter and HVDC System Control	10
4.	Converter Faults and Protection	10
5.	Smoothing Reactor and D.C. Line	08
6.	Reactive Power Control	08
7.	Introduction to Multi Terminal DC system	04
	Total	60

D. COURSE CONTENTS**1. DC POWER TRANSMISSION TECHNOLOGY:**

- 1.1 Introduction
- 1.2 Comparison of A.C. and D.C. transmission
 - 1.2.1. Economics of transmission
 - 1.2.2. Technical performance
 - 1.2.3. Reliability

- 1.3 Application of D.C. Transmission.
- 1.4 Description of D.C. Transmission system
 - 1.4.1. Types of D.C. Link
 - 1.4.2. Converter station
- 1.5 Planning for HVDC Transmission
- 1.6 Modern trends in D.C. Transmission

2. THYRISTOR VALVE:

- 2.1 Thyristor Device
 - 2.1.1 Principle of operation
 - 2.1.2 Device Characteristics
 - 2.1.3 Gate drive
- 2.2 Thyristor Valve
 - 2.2.1 General introduction to Thyristor valve.
 - 2.2.2 Valve firing
 - 2.2.3 Valve design consideration
 - 2.2.4 Valve Protection
- 2.3 Valve tests
- 2.4 Recent Trends of HVDC valves

3. CONVERTER AND HVDC SYSTEM CONTROL:

- 3.1 Principle of DC link control
- 3.2 Converter control characteristics
 - 3.2.1. Basic characteristics
 - 3.2.2. Modification of the control characteristics
- 3.3 System control Hierarchy
- 3.4 Firing angle control
- 3.5 Current and Extinction angle control
- 3.6 Starting and Stopping of D.C. Link
- 3.7 Power Control
- 3.8 Higher level Controller
 - 3.8.1. Frequency and power / frequency control
 - 3.8.2. Stabilization of A.C. ties
 - 3.8.3. Emergency Control
 - 3.8.4. Reactive power Control
- 3.9 Telecommunication Requirements

4. CONVERTER FAULTS AND PROTECTION:

- 4.1 Converter Faults
 - 4.1.1. General Faults
 - 4.1.2. Communication failures
 - 4.1.3. Arc Through
 - 4.1.4. Misfire
 - 4.1.5. Current Extinction
 - 4.1.6. Short circuit in a bridge

- 4.2 Protection against Over-Current
- 4.3 Over voltage in a Converter station
 - 4.3.1. Disturbance of the A.C. side
 - 4.3.2. Disturbance on the D.C. side
 - 4.3.3. Over voltage caused by Internal Converter disturbance
- 4.4 Surge Arresters
- 4.5 Protection against Over voltages
- 5. SMOOTHING REACTOR AND D.C. LINE:**
 - 5.1 Smoothing Reactors and their functions
 - 5.2 Corona effect in D.C. line
 - 5.3 Protection of D.C. line
 - 5.4 D.C. Breakers
- 6. REACTIVE POWER CONTROL:**
 - 6.1 Requirement of reactive power
 - 6.2 Source of Reactive power
 - 6.3 Static VAR system
- 7. INTRODUCTION TO MULTI TERMINAL DC SYSTEM:**
 - 7.1 Potential applications of MTDC system
 - 7.2 Types of MTDC system

Learning Resources:

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1.	K R Padiyar	HVDC Power Transmission Systems	NewAge International (P) Ltd

ELECTRICAL WORKS PRACTICE

Name of the Course: Diploma in Electrical Engineering

Course code:	DEEW6203	Semester	6 th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P / week	Term Work	50
Maximum marks:	100	End Semester Examination:	50

Rationale: The sole objective of the subject is skill development among the Technician/ Diploma holder after performing practice of the experiments and become fit to meet the challenges in practical installation.

In the beginning the faculties have to illustrate all the tools and instruments required/ used in conducting this subject. The faculty and students are required to make a thorough hand on approach in practicing the experiments.

List of Experiment:

1. Identification of single core (SC), twin core (TC), three cores (3c), four cores (4c); copper and aluminum PVC, VIR & Weather proof (WP) wire and prepare Britannia T-joint and Married joint.
2. Cutting copper and aluminum cable and crimping lug to them from 4mm² to 25mm², cross section.
3. Connection and testing of fluorescent tube light, high pressure M.V. lamp, sodium vapor lamp, M.H lamp, CFL and latest model lamps – measure inductance, Lux/ lumens (intensity of illumination) in each case-prepare lux table .
4. Study battery charger and make charging of lead acid battery (record charging voltage, current and specific gravity).
5. Erection of residential building wiring by CTS and conduit wiring system using main two points and test installation by test lamp method and a meggar.
6. Fault finding & repairing of Fan – prepare an inventory list of parts.
7. Find out fault of D.C. generator, repair and test it to run.
8. Find out fault of D.C. motor starters and A.C motor starter – prepare an inventory list of parts used in different starters.
9. Use crimping tools to lug sockets on L.T. & H.T aluminum cable from 10mm² to 50mm².
10. Dismantle, over haul and assemble a single phase induction motor. Test and run it. – prepare an inventory list.
11. Dismantle over haul and assemble a three phase squirrel cage and phase wound motor. Test and run them.
12. Overhaul a single phase / 3 phase variac.

ELECTRICAL PROJECT & SEMINAR

Name of the Course: Diploma in Electrical Engineering

Course code:	DEEP 6201	Semester	6 th
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P / week	Term Work	50
Maximum marks:	100	End Semester Examination:	50

A. RATIONALE:

The project work is to integrate the knowledge, skill and attitudes developed after completion of the subjects for developing competency in a particular specialized job. In this activity the role of teacher is a facilitator coordinator. The students will select a topic, perform design work, place the indents and get the raw materials either from the department or from the local market and implement the design. The leadership quality, coordination of job and maintaining a good communal harmony is important factor of this type of activity. It is the process, which is to be evaluated along with student's knowledge and their dedication. The success of the project is no doubt the goal but the group activity will also be critically evaluated.

B. OBJECTIVES

On completion of the project work the students will be able to

1. Select a suitable topic.
2. Designing of the job (may use computer simulation software).
3. Scheduling the job.
4. Indenting.
5. Procuring of materials.
6. Developing leadership quality.
7. Developing cost awareness.
8. Effective utilization of time.
9. Develop marketing strategies.

C. COURSE CONTENT (in terms of specific objective)

(Group of 8 to 10 students)

Suggested list of projects

1. Construction of automatic water level controller. (Use of any sensor)
2. Design and winding of single phase transformer (up to 1KVA)
3. Rewinding of 3 phase induction motor (3-HP)
4. Rewinding of single phase capacitor motor.
5. Fabrication of semi automatic star-delta starter.
6. Assembling of single phase voltage stabilizer (1 KVA)
7. Assembling of desert cooler.
8. Energy survey and implementation of energy saving scheme in Polytechnic building.
9. Fabrication of controlled rectifier (using RC or cosine firing circuit)

10. Chopper based speed controller of D.C Shunt motor.
11. Fabrication of AC controller using TRIAC.
12. Fabrication of single phase PWM inverter

NOTE :

A group of 8 to 10 students have to perform any one project and prepare its report. In the project work project is to be prepared along with Project report in details, which includes design process, list of components used, testing of component, fabrication and work distribution, testing and fault finding, drawing of circuit diagram and costing etc.

SEMINAR :

Project report should be defended in the classroom in the presence of at least two Experts (better to be one from industries) and Questions and doubts from the students as well as from experts should also be invited.

SIMULATION PRACTICE ON MATLAB

Name of the Course: Diploma in Electrical Engineering

Course code:	DESM6202	Semester	6 th
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P / week	Term Work	25
Maximum marks:	50	End Semester Examination:	25

A. RATIONALE:

Computer simulation is necessary for any hardware, before its fabrication. MATLAB software provides a unique platform for computer simulation. Practice on MATLAB has been opted for final semester students to be familiar with programming and simulation practice with SIMULINK to make them comfortable for designing various hardware projects and verify different experiments in absence of proto type experimental equipments.

B. COURSE CONTENT (in terms of specific objective)

1. **Introduction to MATLAB programming:** 20

1.1. Functions and operation using variables and arrays.

1.1.1. To learn algebraic, trigonometric and exponential manipulation.

1.1.2. To learn Arithmetic, Relational and Logic operator.

1.2. Matrix formation and its manipulation.

1.3. Vector manipulation:

1.3.1. Use of linspace to create vectors.

1.3.2. To create, add and multiply vectors.

1.3.3. Use of sin and sqrt functions with vector arguments.

1.4. Plotting:

1.4.1. Two dimensional Plots and sub plots

1.4.2. Label the plot and printing.

1.5. Write and execute a file to plot a circle, impulse, step, ramp, sine and cosine functions. .

2. **Introduction to SIMULINK:** 40

2.1. Use of Commonly used blocks, Math operation block and Display block from SIMULINK library.

2.2. Use of logical and relational operator block.

2.3. Use of Sim-Power system block to use Electrical sources, elements and Power electronics devices.

2.4. SIMULATION:

2.4.1. Verification of Network theorems. (any two)

2.4.2. Simulation of a half wave uncontrolled rectifier.

2.4.3. Simulation of 1-phase full bridge controlled rectifier.

2.4.4. Simulation of step-down chopper.

Learning

Resources:

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1.	Agam Kumar Tyagi	MATLAB and Simulink for Engineers	Oxford
2.	Rudra Pratap	Getting started with MATLAB	