

## STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

**TEACHING AND EVALUATION SCHEME FOR 6th Semester (Electrical and Mechanical Engineering) (wef 2020-21)**

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
<b>Theory</b>									
Th.1		Electrical Installation and Estimating	5	-	-	20	80	3	100
Th.2		Switch gear and Protective Devices	5	-	-	20	80	3	100
Th.3		Mechanical Measurement & Control	5	-	-	20	80	3	100
Th.4		Elective (Any one to be opted) a. Renewable Energy System b. Power Plant Engineering	5	-	-	20	80	3	100
		<i>Total</i>	20	-		80	320	-	400
<b>Practical</b>									
Pr.1		CAD/CAM Lab			6	50	100	3	150
Pr.2		Project Phase-II			8	50	100	3	150
Pr.3		Life Skill			2	50	-	-	50
		Student Centered Activities (SCA)		-	3	-	-	-	-
		<i>Total</i>	-	-	19	150	200	-	350
		<b>Grand Total</b>	<b>20</b>	<b>-</b>	<b>19</b>	<b>230</b>	<b>520</b>	<b>-</b>	<b>750</b>

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

**Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%**

**SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM/Idea Tinkering and Innovation Lab Practice etc. ,Seminar and SCA shall be conducted in a section.**

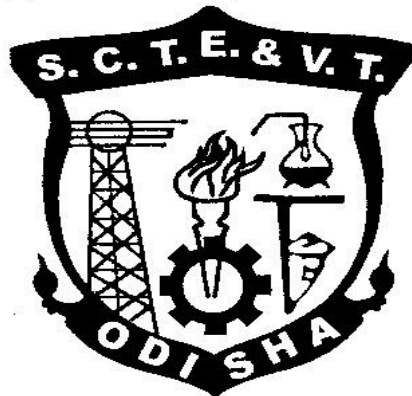
**There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester**

# **CURRICULLUM OF 6<sup>TH</sup> SEMESTER**

**For**

## **DIPLOMA IN ELECTRICAL AND MECHANICAL ENGINEERING**

**(Effective from 2020-21 Sessions)**



**STATE COUNCIL FOR TECHNICAL EDUCATION &  
VOCATIONAL TRAINING, ODISHA, BHUBANESWAR**

**Th1. ELECTRICAL INSTALLATION AND ESTIMATING**

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Th.1	Semester	6 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5P / week	Class Test:	20
Tutorial:	-	End Semester Examination:	80
Maximum marks:	100		

**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
	<b>Total</b>	<b>75</b>

**D. COURSE CONTENTS**

<b>1.</b>	<b>INDIAN ELECTRICITY RULES</b>	
	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,	

	<p>48, 49, 50, 51, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70.</p> <p>1.4 OH lines : Rule 74, 75, 76, 77, 78, 79, 80, 86, 87, 88, 89, 90, 91</p>	
<b>2.</b>	<p><b>ELECTRICAL INSTALLATIONS</b></p> <p>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.</p> <p>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.</p> <p>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.</p>	
<b>3.</b>	<p><b>INTERNAL WIRING</b></p> <p>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.</p> <p>3.2 Prepare one estimate of materials required for CTS wiring for small domestic installation of one room and one verandah within 25 m<sup>2</sup> with given light, fan &amp; plug points.</p> <p>3.3 Prepare one estimate of materials required for conduit wiring for small domestic installation of one room and one verandha within 25 m<sup>2</sup> with given light, fan &amp; plug points.</p> <p>3.4 Prepare one estimate of materials required for concealed wiring for domestic installation of two rooms and one latrine, bath, kitchen &amp; verandah within 80m<sup>2</sup> with given light, fan &amp; plug points.</p> <p>3.5 Prepare one estimate of materials required for erection of conduct wiring to a small workshop installation about 30m<sup>2</sup> and load within 10 KW.</p>	
<b>4.</b>	<p><b>OVER HEAD INSTALLATION</b></p> <p>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</p>	

	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>		
<b>5.</b>	<p><b>OVER HEAD SERVICE LINES</b></p> <p>5.1 Components of service lines, service line (cables and conductors), bearer wire, lacing rod. Ariel fuse, service support, energy box and meters etc.</p> <p>5.2 Prepare and estimate for providing single phase supply of load of 5 KW (light, fan, socket) to a single stored residential building.</p> <p>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.</p> <p>5.4 Prepare one estimate of materials required for service connection to a factory building with load within 15 KW using insulated wire.</p> <p>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.</p>		
<b>6.</b>	<p><b>ESTIMATING FOR DISTRIBUTION SUBSTATIONS</b></p> <p>6.1 Prepare one materials estimate for following types of transformer substations.</p> <p>6.1.1 Pole mounted substation</p> <p>6.1.2 Plinth Mounted substation.</p>		
<b>Learning Resources:</b>			
<b>Sl.No</b>	<b>Name of Authors</b>	<b>Title of the Book</b>	<b>Name of Publisher</b>

VI Sem Electrical and Mechanical

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
3	N. Alagappan S.Ekambaram	Electrical Estimating and Costing	TATA McGRAW HILL

## Th2. SWITCH GEAR AND PROTECTIVE DEVICES

Name of the Course: Diploma in Electrical & Mechanical Engineering			
Course code:	Th.2	Semester	6 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

### 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.

### B. OBJECTIVE:

After completion of this subject the student will be able to know:

- 1) The basic principles of protection of alternator, transformer and feeders.
- 2) Fuse and Circuit breaker.
- 3) Protective Relay.
- 4) Lighting Arrestor.
- 5) 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	6
4	Circuit breakers	10
5	Protective relays	8
6	Protection of electrical power equipment and lines	6
7	Protection against over voltage and lightning	8
8	Static relay	6
<b>Total:</b>		<b>75</b>

### D. COURSE CONTENTS:

#### 1. INTRODUCTION TO SWITCHGEAR

- 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 Faults in a power system.

#### 2. FAULT CALCULATION

- 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**

- 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**

- 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 (SF<sub>6</sub>) 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**

- 5.1 Definition of Protective Relay.
- 5.2 Fundamental requirement of protective relay.
- 5.3 Basic Relay operation
  - 5.3.1. Electromagnetic Attraction type
  - 5.3.2. Induction type
- 5.4 Definition of following important terms
- 5.5 Definition of following important terms.
  - 5.5.1. Pick-up current.
  - 5.5.2. Current setting.
  - 5.5.3. Plug setting Multiplier.
  - 5.5.4. 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
  - 5.10.1. Current differential relay
  - 5.10.2. Voltage balance differential relay.
- 5.11 Types of protection

**6. PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES**

- 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**

- 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 and Type of lightning Arresters.
  - 7.7.1. Rod-gap lightning arrester.
  - 7.7.2. Horn-gap arrester.
  - 7.7.3. Valve type arrester.
- 7.8. Surge Absorber

**8. STATIC RELAY:**

- 8. 1 Advantage of static relay.
- 8. 2 Instantaneous over current relay.
- 8. 3 Principle of IDMT relay.

**Syllabus coverage up to Internal assessment**

Chapters: 1, 2, 3 and 4.

<b>Learning Resources:</b>			
<b>Sl.No</b>	<b>Title of the Book</b>	<b>Name of Authors</b>	<b>Publisher</b>
1	Principle of power system	V. K. Mehta	S Chand
2.	Protection and Switchgear	Bhavesh Bhalja R.P Maheshwari Nilesh G. Chothani	OXFORD
2	Electrical power	Soni, Gupta and Bhatnagar	Dhanpat Rai & Sons
3	Power system protection & switch gear	Bhuvanesh Oza	TMH
4	Electrical Power	S. L. Uppal	Khanna Publisher
5	Protection and Switchgear	Raghuraman	SCITECH

## Th.3. MECHANICAL MEASUREMENT & CONTROL

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Th.3	Semester	6 <sup>th</sup>
Total Period:	75	Examination	3 hrs.
Theory periods:	5 P / week	Class Test:	20
Tutorial:	-	End Semester Examination:	80
Maximum marks:	100		
<p><b>A. RATIONALE:</b> Diploma holders in this course required to measure for ensuring quality of product. For this purpose, knowledge &amp; skills about standards of measurement, limits, fits &amp; tolerances and various measuring instruments are necessary.</p>			
<p><b>B. OBJECTIVE:</b></p> <ol style="list-style-type: none"> <li>1. Understanding the measurement process and types by using various measuring instruments.</li> <li>2. Understanding the concept of limit, fits and tolerance in manufacturing.</li> <li>3. Understanding the concept of transducers for measuring the parameters like pressure, displacement, temperature, strain etc. with more accuracy.</li> </ol>			
<p><b>C. Topic wise distribution of periods:</b></p>			
Sl. No.	Topics	Periods	
1	Introduction to measurement	10	
2	Linear measurement	05	
3	Angular measurement	06	
4	Limits fits and tolerances	12	
5	Transducers	10	
6	Strain Measurement	10	
7	Measurement of Pressure	10	
8	Temperature measurement	12	
	<b>TOTAL</b>	<b>75</b>	
<p><b>D. COURSE CONTENTS</b></p>			
1.	<p><b>Introduction to measurement:</b></p> <ol style="list-style-type: none"> <li>1.1 Definition of metrology.</li> <li>1.2 Standards of measurement.</li> <li>1.3 Precision and accuracy, errors in measurement.</li> <li>1.4 Construction and working of Dial test indicators. Advantages and uses.</li> <li>1.5 Need and principles of comparators. Classifications: mechanical, electrical, optical and pneumatic.</li> </ol>		

<b>2.</b>	<b>Linear measurement:</b> 2.1 Study of linear measuring instruments like calipers, surface plate, straight edge, Vernier calipers, micrometers, Vernier height gauge, depth gauge, slip gauges.		
<b>3.</b>	<b>Angular measurement:</b> 3.1. Study of angular measuring instruments like bevel protractor, sine bars. 3.2. Use of sine bars. Limitation and practical applications.		
<b>4.</b>	<b>Limits fits and tolerances:</b> 4.1. Terminology of limits and fits. 4.2. Conventional diagram for limits and fits. 4.3. Limit. Types of limits. Fits. Types of fits. 4.4. Tolerance and allowance. Unilateral and bilateral system. 4.5. Hole basis and shaft basis system. 4.6. Taylor's principle of gauge design (GO and NOT GO gauge)		
<b>5.</b>	<b>Transducers:</b> 5.1. Define transducer. 5.2. Classification of transducers. 5.3. Requirements of transducers. 5.4. Resistance, capacitance and inductance type transducers.		
<b>6.</b>	<b>Strain Measurement:</b> 6.1. The electrical resistance strain gauge. 6.2. The metallic resistance strain gauge.		
<b>7.</b>	<b>Measurement of Pressure :</b> 7.1 Define Pressure measurement devices. 7.2 Mechanical instruments 7.3 Electro-mechanical instruments 7.4 Electronic instruments		
<b>8.</b>	<b>Temperature measurement:</b> 8.1 Classify temperature measuring instruments. 8.2 Explain different mechanical temperature sensors 8.3 Explain electrical temperature sensors 8.4 Explain optical sensors.		
<b><u>Syllabus coverage up to Internal assessment</u></b> Chapters: 1, 2, 3, 4 and 5.			
<b>Learning Resources:</b>			
<b>Sl.No</b>	<b>Title of the Book</b>	<b>Name of Authors</b>	<b>Name of Publisher</b>
1.	Engineering Metrology	R.K Jain	Khanna Publisher
2.	Engineering Metrology	M. Mahajan	Dhanpat Rai & Co.
3.	A course in measurement and instrumentation	A.K Sawhney and P.K Sawhney	Dhanpat Rai

## Th.4 RENEWABLE ENERGY SYSTEMS (Elective – A)

Name of the Course: Diploma in Electrical & Mechanical Engineering			
Course code:	Th.4	Semester	6 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5 P / week	Class Test:	20
Tutorial:	-	End Semester Examination:	80
Maximum marks:	100		

### A. RATIONALE:

It is well known that a plenty of energy is needed to sustain industrial growth and agricultural production. The existing sources energy such as coal, oil, uranium etc may not be sufficient to meet the ever increasing energy demands. These conventional sources of energy are also depleting and may be exhausted at the end of the century or the beginning of the next century.

Consequently sincere efforts shall have to be made by the scientists and engineers in exploring the possibilities of harnessing energy from several energy sources.

### B. OBJECTIVE:

After completion of this subject the student will be able:

1. Power production from pollution free forces and environment friendly resources.
2. Production of power form nature at free of cost.
3. Solar energy conversion is noiseless and cheap.

### C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Introduction to Renewable energy	5
2.	Solar Energy	20
3.	Wind Energy	15
4.	Biomass Power	16
5.	Other Energy Sources	19
	<b>Total</b>	<b>75</b>

### D. COURSE CONTENTS

#### 1. Introduction to Renewable energy:

- 1.1. Environmental consequences of fossil fuel use.
- 1.2. Importance of renewable sources of energy.
- 1.3. Sustainable Design and development.
- 1.4. Types of RE sources.
- 1.5. Limitations of RE sources.
- 1.6. Present Indian and international energy scenario of conventional and RE sources.

#### 2. Solar Energy:

- 2.1. Solar photovoltaic system-Operating principle.
  - 2.2. Photovoltaic cell concepts
    - 2.2.1. Cell, module, array, Series and parallel connections. Maximum power point tracking (MPPT).
  - 2.3. Classification of energy Sources.
  - 2.4. Extra-terrestrial and terrestrial Radiation.
  - 2.5. Azimuth angle, Zenith angle, Hour angle, Irradiance, Solar constant.
  - 2.6. Solar collectors, Types and performance characteristics,
  - 2.7. Applications: Photovoltaic - battery charger, domestic lighting, street lighting, water pumping, solar cooker, Solar Pond.
- 3. Wind Energy:**
- 3.1. Introduction to Wind energy.
  - 3.2. Wind energy conversion.
  - 3.3. Types of wind turbines
  - 3.4. Aerodynamics of wind rotors.
  - 3.5. Wind turbine control systems; conversion to electrical power:
  - 3.6. Induction and synchronous generators.
  - 3.7. Grid connected and self excited induction generator operation.
  - 3.8. Constant voltage and constant frequency generation with power electronic control.
  - 3.9. Single and double output systems.
  - 3.10. Characteristics of wind power plant.
- 4. Biomass Power:**
- 4.1. Energy from Biomass.
  - 4.2. Biomass as Renewable Energy Source
  - 4.3. Types of Biomass Fuels - Solid, Liquid and Gas.
  - 4.4. Combustion and fermentation.
  - 4.5. Anaerobic digestion.
  - 4.6. Types of biogas digester.
  - 4.7. Wood gassifier.
  - 4.8. Pyrolysis,.
  - 4.9. Applications: Bio gas, Bio diesel
- 5. Other Energy Sources**
- 5.1. Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems.
  - 5.2. Ocean Thermal Energy Conversion (OTEC).
  - 5.3. Geothermal Energy – Classification.
  - 5.4. Hybrid Energy Systems.
  - 5.5. Need for Hybrid Systems.
  - 5.6. Diesel-PV, Wind-PV, Microhydel-PV.
  - 5.7. Electric and hybrid electric vehicles.

**Syllabus coverage up to Internal assessment**

Chapters: 1, 2 and 3.

<b>Learning Resources:</b>			
<b>Sl.No</b>	<b>Title of the Book</b>	<b>Name of Authors</b>	<b>Name of Publisher</b>
1.	<i>Renewable Energy Sources and Emerging Technologies</i>	<i>D.P.Kothari, K.C Singal, Rakesh Ranjan</i>	<i>PHI Learning Pvt.Ltd, New Delhi</i>
2.	<i>Non-Conventional Energy Resources</i>	<i>B.H.Khan</i>	<i>Tata McGrawHill</i>
3	<i>Non-Conventional Energy Resources</i>	<i>J.P Navani &amp; Sonal Sapra</i>	<i>S chand</i>
4.	<i>Non Conventional Energy sources and Utilisation</i>	<i>R K Rajput</i>	<i>S Chand</i>
5	<i>Wind Electrical Systems</i>	<i>S. N. Bhadra, D. Kastha, S. Banerjee</i>	<i>Oxford Univ. Press, New Delhi</i>
6.	<i>Non Conventional Energy Resources</i>	<i>N K Bansal</i>	<i>S Chand</i>

## Th.4 POWERPLANT ENGINEERING (Elective – B)

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Th.4	Semester	6 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5 P / week	Class Test:	20
Tutorial:	-	End Semester Examination:	80
Maximum marks:	100		
<b>E. RATIONALE:</b> Bulk powers used in industries and for domestic purposes are generated in power plants. A large number of diverse and specialized equipment and system are used in a power plant should have this specialized elective course.			
<b>F. OBJECTIVE:</b> <ol style="list-style-type: none"> <li>1. Understanding the generation of power by utilizing various energy sources.</li> <li>2. Understanding the use of steam, its operation in steam power plants.</li> <li>3. Understanding the nuclear energy sources and power developed in nuclear power plant.</li> <li>4. Understanding the basics of gas turbine power plant, diesel engine power plant and hydroelectric power plant.</li> </ol>			
<b>G. Topic wise distribution of periods:</b>			
<b>Sl. No.</b>	<b>Topics</b>		<b>Periods</b>
1.	Introduction to Energy sources		05
2.	Steam Power Plant		30
3.	Nuclear Power Plant		15
4.	Diesel Engine Power plant		15
5.	Hydel Power plant		10
	<b>TOTAL</b>		<b>75</b>
<b>H. COURSE CONTENTS</b>			
<b>1.</b>	<b>1.1 Introduction to Energy sources:</b> 1.2 Describe sources of energy. 1.3 Explain concept of Central and Captive power station. 1.4 Classify power plants		
<b>2.</b>	<b>Steam Power Plant:</b> 2.1. Layout of steam power plant. 2.2. Steam power cycle. 2.3. Explain Rankine cycle with P-V, T-S & H-s diagram and determine thermal efficiency, Work done, work ratio, and specific steam Consumption. 2.4. Solve Simple Problems.		

	<p>2.5. Explain reheat cycle and regenerative cycle and combination of reheat and regenerative cycle.</p> <p>2.6. Boiler Accessories: Air pre heater, Economizer, Electrostatic precipitator and super heater. Need of boiler mountings.</p> <p>2.7. Draught systems (Natural draught, Forced draught &amp; balanced draught) with their advantages &amp; disadvantages.</p> <p>2.8. Steam prime movers: Advantages &amp; disadvantages of steam turbine, Elements of steam turbine, Compounding and governing of steam turbine.</p> <p>2.9. Performance of steam turbine: Explain Thermal efficiency, Stage efficiency and Gross efficiency.</p> <p>2.10. Solve Simple problems.</p> <p>2.11. Steam condenser:</p> <p>2.12. Function of condenser, Classification of condenser (explain jet and surface condensers), function of condenser auxiliaries such as hot well, condenser extraction pump, air extraction pump, cooling water and circulating pump.</p> <p>2.13. Cooling Tower:</p> <p>2.14. Function and types of cooling tower, Describe the various types of cooling tower (Natural draft cooling tower and Mechanical draft cooling tower)</p>		
<b>3.</b>	<p><b>Nuclear Power Plant:</b></p> <p>3.1. Classify nuclear fuel (Fissile &amp; fertile material)</p> <p>3.2. Explain fusion and fission reaction.</p> <p>3.3. Explain nuclear reactor: Components of nuclear reactor such as fuel, moderator, reflector, coolant, control rod, Shielding, reactor vessel &amp; their function.</p> <p>3.4. Explain the working principle of PWR and BWR power plant.</p> <p>3.5. Compare the nuclear and thermal plants.</p> <p>3.6. Explain the disposal of nuclear waste.</p>		
<b>4.</b>	<p><b>Diesel Engine Power plant:</b></p> <p>4.1. State the advantages and disadvantages of diesel plant.</p> <p>4.2. Explain briefly different systems of diesel power plant: Fuel storage and fuel supply system, Fuel injection system, Air supply system, Exhaust system, Cooling system, Lubrication system, Starting system, Governing system.</p>		
<b>5.</b>	<p><b>Hydel Power plant:</b></p> <p>5.1. State advantages and disadvantages of hydroelectric power plant.</p> <p>5.2. Classify and Explain the general arrangement of storage type hydroelectric project and Explain its operation.</p>		
<p><b><u>Syllabus coverage up to Internal assessment</u></b></p> <p>Chapters: 1, 2 and 3.</p>			
<p><b>Learning Resources:</b></p>			
<b>Sl.No</b>	<b>Title of the Book</b>	<b>Name of Authors</b>	<b>Name of Publisher</b>



VI Sem Electrical and Mechanical

1.	Power plant engineering	R.K Rajput	Laxmi Publication
2.	Power plant engineering	P.K.Nag	TMH
3.	Power plant engineering	Nagpal G.R	Khanna Publisher

## **Pr.1.CAD/CAM LAB**

Name of the Course: Diploma in Electrical & Mechanical Engg.			
Course code:	Pr.1	Semester	6th
Total Period:	90		
Theory periods:	6 P/Week	Sessional:	50
Maximum marks:	150	End Semester Examination:	100

### **COURSE OBJECTIVES**

Students will develop ability towards

- 1.To understand the fundamentals and use of CAD.
- 2.To conceptualize drafting and modelling in CAD.
- 3.To interpret the various features in the menu of solid modelling package.
- 4.To synthesize various parts or components in an assembly.
- 5.Toprepare CNC programmes for various jobs

### **COURSE CONTENTS**

#### **PART-A.**

INTRODUCTION;

Part modelling, Datum plane, Datum plane; constraint; dimensioning; extrude; revolve; sweep; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient.

**EXERCISES:**

**2D Drawings of Rectangle, circle, polygon and its dimensioning**

**3D Drawings of;**

**1.Gib and cutter joint**

**2.Screw Jack;**

**3.Connecting Rod;**

**4.Bearing Block.**

**Print the orthographic view from the above assembled 3Ddrawing**

#### **PART-B.**

## CNC Programming and Machining

### INTRODUCTION;

- 1.Study of CNC lathe, milling;
- 2.Study of international codes; G-Codes and M –Codes
- 3.Format –Dimensioning methods;
- 4.Programme writing –Turning Simulator-Milling simulator IS practice-commands menus
- 5.Editing the programme in the CNC MACHINES;
- 6.Execute the programme in the CNC machines;

### **Exercise;**

Print the programme and make the component in the CNC machine;

- 7.Using canned cycle-create a part programme for thread cutting, grooving and produce component in the CNC Turning Machine
- 8.Using Linear interpolation and Circular Interpolation-Create a part programme for grooving and produce component in the CNC Milling Machine

## Pr2. PROJECT Phase - II

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:		Semester	6 <sup>th</sup>
Total Period:	120	Examination	3 hrs
Lab. periods:	8 P / week	Sessional	50
Maximum marks:	150	End Sem Examination	100

### RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Electrical and Mechanical engineering and practices in real life situations, so as to participate and manage a large Electrical and Mechanical engineering projects, in future. Entire Project spreads over 5<sup>th</sup> and 6<sup>th</sup> Semester. Part of the Project covered in 5<sup>th</sup> Semester was named as *Project Phase-I* and balance portion to be covered in 6<sup>th</sup> Semester shall be named as *Project Phase-II*.

### OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.

- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

### **Project Phase-I and Phase-II**

The Project work duration covers 2 semesters(5<sup>th</sup> and 6<sup>th</sup> sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5<sup>th</sup> semester under Project Phase-I. The students were allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-II in 6<sup>th</sup> semester there shall be one presentation by each group on whole Project work undertaken by them.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

<b>Sl. No.</b>	<b>Performance Criteria</b>
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

### Organization of Project Report

1. Cover page:

It should contain the following ( in order)

- (i) Title of the Project
- (ii) “Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>”
- (iii) By Name of the Student(s)
- (iv) Logo of the Institution
- (v) Branch Name/Depart Name and Institution Name with Address
- (vi) Academic Year

2. 1<sup>st</sup> Inner page

Certificate:

It should contain he following

“This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>” during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

Seal and signature of the Supervisor/Guide with date

3. 2<sup>nd</sup> Inner Page

Acknowledgement by the Student(s)

4. Contents.

5. Chapter wise arrangement of Reports

6. Last Chapter: Conclusion

It should contain

- (i) Conclusion
- (ii) Limitations
- (iii) Scope for further Improvement

7. References

## Pr-4 LIFE SKILL

(Common to All Branches)

<b>Practical</b>	<b>2 Periods per week</b>	<b>Sessional</b>	<b>50 Marks</b>
<b>Total Periods</b>	<b>30 Periods</b>	<b>Total Marks</b>	<b>50 Marks</b>

**Objective:** After completion of this course the student will be able to:

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

### DETAIL CONTENTS:

#### 1. SOCIAL SKILL

Society, Social Structure, Develop Sympathy and Empathy  
 Swot Analysis – Concept, How to make use of SWOT  
 Inter personal Relation: Sources of conflict, Resolution of conflict ,  
 Ways to enhance interpersonal relation

#### 2. PROBLEM SOLVING

Steps of Problem solving:

- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

#### 3. PRESENTATION SKILL

Body language , Dress like the audience  
 Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,  
 Voice and language – Volume, Pitch, Inflection, Speed, Pause  
 Pronunciation, Articulation, Language, Practice of speech.  
 Use of AV aids such as Laptop with LCD projector, white board etc.

#### **4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES**

##### *Group Discussion:*

Introduction to group discussion, Ways to carry out group discussion, Parameters— Contact, body language, analytical and logical thinking, decision making

##### *Interview Technique :*

Dress, Posture, Gestures, facial expression, Approach  
Tips for handling common questions.

#### **5. WORKING IN TEAM**

Understand and work within the dynamics of a groups.

Tips to work effectively in teams,

Establish good rapport, interest with others and work effectively with them to meet common objectives,

Tips to provide and accept feedback in a constructive and considerate way ,  
Leadership in teams, Handling frustrations in group.

#### **6. TASK MANAGEMENT**

Introduction, Task identification, Task planning ,  
organizing and execution, Closing the task

### **PRACTICAL**

**List of Assignment:** *(Any Five to be performed including Mock Interview)*

#### **1. SWOT analysis:-**

Analyse yourself with respect to your strength and weaknesses, opportunities and threats.  
Following points will be useful for doing SWOT.

- a) Your past experiences,
- b) Achievements,
- c) Failures,
- d) Feedback from others etc.

#### **2. Solve the True life problem assigned by the Teacher.**

#### **3. Working in a Team**

Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc.( One activity per group where Team work shall be exhibited)

#### **4. Mock Interview**

#### **5. Discuss a topic in a group and prepare minutes of discussion.**

#### **6. Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.**

#### **7. Task Management**

Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)



**Note:** -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.

**Note:** -2. The following Topics may be considered for Seminar/GD in addition to other Topics at the discretion of the Teacher.

(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation ,Harassment of Women at Workplace)

### **METHODOLOGY:**

*The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.*

### **Books Recommended:-**

<b>Sl.No</b>	<b>Name of Authors</b>	<b>Title of the Book</b>	<b>Name of the Publisher</b>
01	E.H. Mc Grath , S.J	Basic Managerial Skills for All	PHI
02	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
03	Adair, J	Decision making & Problem Solving	Orient Longman
04	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
05	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.

## **EQUIPMENT LISTS**

**PRACTICAL- 1- CAD/CAM LAB**

<b><u>SL.NO</u></b>	<b><u>NAME OF THE EQUIPMENTS</u></b>	<b><u>QUANTITY</u></b>
<b>01</b>	<b>DESKTOP COMPUTER</b>	<b>20 no</b>
<b>02</b>	<b>AUTOCAD SOFTWARE 2D/3D</b>	<b>01 each</b>
<b>03</b>	<b>CNC TURNING MACHINE</b>	<b>01 no</b>
<b>04</b>	<b>CNC MILLING MACHINE</b>	<b>01 no</b>
<b>05</b>	<b>PRINTER</b>	<b>02 no</b>