

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**COURSE TITLE: PLANT EQUIPMENT ERECTION AND MAINTENANCE
(Code: 3345503)**

Diploma Programme in which this course is offered	Semester in which offered
Fabrication Technology	4 th Semester

1. RATIONALE

Proper maintenance of process plant equipment is very important if we want to assure quality of product. In the absence of proper erection & maintenance of equipment it becomes difficult to manage smooth and quality production. This course provides the underpinning knowledge and skills necessary to enhance and develop the repair and maintenance of different types of process plant equipments, interlinking of different equipments, process piping, erection and maintenance. This will enable student to work in the field of site erection work & solve process plant maintenance problems and to identify their causes and remedies etc.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Plan and Supervise maintenance & erection work of process plant equipment by using appropriate method in a safest manner**

3. COURSE OUTCOME (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Draws Schematic Diagrams of various Power Plants.
- Describes constructional features & operations of various equipment and machinery of a given plant.
- Installs / Erects given Equipment / Machine.
- Draws Foundation Layout / Plan / Drawing for given Equipment or Machine or Structure.
- Prepares the maintenance plan of given equipment / machine / plant

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	-	2	6	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit;; ESE - End Semester Examination; PA - Progressive Assessment.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Basics Of Process Plant	1a. Describe Process Plants. 1b. Draw Schematic diagram of Production plant. 1c. Draw Schematic Diagrams of different types of Power Plants.	1.1 Definition of Plant 1.2 Classification chart of plants 1.3 Definition & types of Production plant 1.4 Schematic diagram of Production plant 1.5 Definition & types of Process plant 1.6 Schematic diagram of Process plant 1.7 Definition & types of Power plants 1.8 Schematic diagram of; 1.8.1 Thermal power plant 1.8.2 Hydro power plant 1.8.3 Diesel power plant 1.8.4 Nuclear power plant 1.9 Classification of Plant equipment
Unit– II Static Equipment	2a. Draw Constructional figure of different Static Equipment 2b. Explain working of different Static Equipment. 2c. Describe Application of different Static Equipment	2.1 Boilers 2.1.1 Definition as per IBR 2.1.2 Classification Chart 2.1.3 Constructional figure and Working of Cochran Boiler 2.1.4 Constructional figure and Working of Lancashire boiler. 2.1.5 Difference between Fire tube and Water tube Boiler 2.1.6 Constructional figure and Working of High Pressure LaMount Boiler 2.1.7 Factors affecting selection 2.1.8 List of Different Mountings and Accessories of Boiler and their 2.1.9 Functions 2.2 Definition, Function and constructional figure of 1. Pressure vessels 2. Storage Vessels 3. Reaction Vessel 4. Heat exchangers 5. Evaporators 6. Crystallisers

Unit	Major Learning Outcomes (Outcomes in cognitive domain)	Topics and Sub-topics
		7. Distillation and Absorption Columns 8. Condenser 9. Cooling Tower 10. Piping system
Unit– III Rotary Equipment	3a. Draw Constructional diagram of different Rotary Equipment. 3b. Describe working and applications of different Rotary Equipment.	3.1. Pumps 3.1.1 Definition 3.1.2 Classification 3.1.3 Applications 3.1.4 Working of Reciprocating Pump 3.1.5 Construction of Centrifugal Pump 3.1.6 Installation/Working of Centrifugal Pump 3.1.7 Priming 3.1.8 Gear Pump 3.1.9 Difference between Centrifugal and Reciprocating pump 3.2 Valves 3.2.1 Definition 3.2.2 Types 3.2.3 Specification 3.2.4 Function 3.2.5 Elements 3.2.6 Applications 3.3 Air Compressors 3.3.1 Definition 3.3.2 Function 3.3.3 Classification chart 3.3.4 Construction & working of Reciprocating Air Compressor 3.3.5 Construction & working of Centrifugal Air Compressor 3.3.6 Applications 3.4 fans & Blowers 3.4.1 Definition of Fan 3.4.2 Definition of Blower 3.4.3 Difference between Fan & Blower

Unit	Major Learning Outcomes (Outcomes in cognitive domain)	Topics and Sub-topics
		3.4.4 Types of Fan 3.4.5 Types of Blower 3.4.6 Industrial applications of Fan & Blower 3.5 Agitators 3.5.1 Definition 3.5.2 Functions 3.5.3 Types 3.6 Filters 3.6.1 Definition 3.6.2 Functions 3.6.3 Types 3.7 Material Handling Equipment 3.7.1 Functions 3.7.2 Classification 3.7.3 Factors affecting Selection of material handling equipment 3.7.7 Function, classification and constructional figure of 1. Cranes 2. Conveyor 3. Lifts and elevators 4. Industrial trucks
Unit– IV Foundations of Machine and Equipment	4a. Draw foundation plan for given equipment 4b. Select and apply the appropriate procedure of preparing foundation for static and rotary equipment	4.1. Definition 4.2. Effect of proper foundation 4.3. Function of foundation 4.4. Classification of foundation 4.5. Design/consideration of foundation 4.6. Foundation material 4.7. Concrete mixture for industrial equipment 4.8. Foundation plan for static and rotary equipment 4.9. Types of foundation bolts 4.10. Difference between foundation of static and rotary equipment
Unit– V Installation and Erection	5a. Identify different erection tools and equipment. 5b. Select proper method of installation for given equipment	5.1 Meaning Of Installation 5.2 Meaning of Erection 5.3 Erection procedure 5.4 Erection equipments Installation procedure of machine / equipment

Unit	Major Learning Outcomes (Outcomes in cognitive domain)	Topics and Sub-topics
	5c. Calculate CG of given process equipment	5.6 Testing and alignment methods 5.5 C.G. calculation of simple shapes.
Unit– VI Corrosion & its Prevention	6a. Explain factors affecting corrosion and types of corrosion. 6b. Select suitable corrosion prevention method in a given situation.	6.1 Definition 6.2 Principle of surface corrosion 6.3 Factors affecting corrosion 6.4 Types of corrosion 6.5 Corrosion prevention methods 6.6 Selection of corrosion prevention method 6.7 Corrosion control in chemical / petro 6.8 chemical plant
Unit– VII Maintenance in Process Plant	7a. Describe aims, functions and responsibilities of maintenance section / department. 7b. Prepare maintenance plan for process plant equipment. 7c. Describe TPM and CBM	7.1 Definition of maintenance engineering 7.2 Aims of maintenance program 7.3 Functions of maintenance department 7.4 Responsibilities of maintenance department 7.5 Types of maintenance 7.6 Definition of maintainability 7.7 Service life of an equipment Condition Monitoring (CM) Definition, principle, advantages & limitation 7.8 Total Productive Maintenance (TPM) 7.9 Condition Based Maintenance (CBM) 7.10 Shut down planning for process plant maintenance.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1	Basics of process plant	8	0	4	4	8
2	Static equipments	10	4	5	3	12
3	Rotary equipments	10	4	5	3	12
4	Foundations of machine and equipments	8	0	5	5	10
5	Installation and erection	6	0	4	4	8
6	Corrosion & its prevention	6	0	4	4	8
7	Maintenance in process plant	8	4	5	3	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
Total Hrs		56	12	32	26	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISE/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Exercise (Outcomes in psychomotor domain)	Approx Hrs. Required
1	I	Take an Overview of different Facilities available in P.E.E.M. Laboratory and prepare list of tools and equipments required for erection and maintenance work. .	02
2	II,VII	Dismantle and Reassemble given Bench vice for its maintenance.	02
3	III,VII	Dismantle and Reassemble given Lathe chuck for its maintenance.	02
4	III,VI,VII	Dismantle and Reassemble given Valve for its maintenance purpose.	02
5	III,VI,VII	Dismantle and Reassemble given Centrifugal pump for its maintenance.	02
6	II,VII	Maintain welding equipment	02
7	V	Perform Linear alignment of given objects having Square/Rectangular Top (e.g. Tables) using Flexible String	02
8	V	Perform Vertical alignment of given object using Plumb-bob	02
9	V	Perform Levelling of given object using Spirit Level.	02
10	V	Perform Levelling and mark points on wall of a building using Transparent Water Tube.	02

11	IV,V	Prepare installation plan for given plant equipment	02
12	VII	Prepare Shut down maintenance plan for typical process plant.	02
13	III	Study centrifugal and reciprocating pump and compare them	02
14	IV	Study foundation of the existing machines and draw the sketch with details of foundation bolts etc.	02
Total Hrs			28

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities:

- Prepare sketchbook of Tools and Equipment required for Erection and Maintenance.
- Presentation of PPT presentation (10 minutes) on given Sub-topic of subject beyond the syllabus
- Report writing on various topics from syllabus and beyond syllabus

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Show video/animation films of different process plants and discuss their operations and if possible show films related to erection commissioning of these plants.
- Arrange visit to process plant and show various erection/commissioning and maintenance activities being carried out.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Title of Books	Author	Publication
1	Structural steel: fabrication & erection	S.K.Saxena & R.B.Asthana	Somaiya Publication Pvt. Ltd.
2	D.L.Material of P.M.& S.M-504	-	C.E.C., C.T.E., Gandhinagar
3	Elements of Mechanical Engg.,	P.S.Desai & S.B.Soni,	Atul Prakashan, Ahmedabad
4	Strength of Material	R.S.Khurmi	S. Chand & Company Ltd., New Delhi
5	Aspects of Material Handling	Dr. K.C.Arora	Laxmi Publications (Pvt.) Ltd.
6	Elements of Mechanical Engineering	N.M.Bhatt & J. R. Mehta	Mahajan Book Depot, Ahmedabad
7	Fluid Mechanics & Hydraulic Machine	R.K.Bansal	Laxmi Publications (Pvt.) Ltd.

B. List of Major Equipment/ Instrument

- i. Bench vice
- ii. Lathe chuck
- iii. Centrifugal pump
- iv. Valve
- v. Maintenance tool kit
- vi. Transparent Water tube
- vii. Sprit level
- viii. Flexible string
- ix. Measuring instruments

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. P. B. Pathak**, Convener & HOD, Department of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. B. K. Gandhi**, Sr. Lecturer, Department of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. S. Y. Merchant**, Sr. Lecturer, Department of Fabrication Technology, Sir B.P.I., Bhavnagar

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. A. K. Sarathe**, Associate Professor, Department of Mechanical Engineering.
- **Prof. Sharad Pradhan**, Head and Associate professor, Department of Mechanical Engineering.