GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

FABRICATION TECHNOLOGY -1
(Code: 3335505)

Diploma Programme in which this course is offered	Semester in which offered
Fabrication Technology	3rd Semester

1. RATIONALE

This course focuses on different types of structural fabrication work. It helps to describe application of different tools, equipments & machineries used in structural fabrication industries. This course also tries to develop safety awareness required in structural fabrication work. In this course provision is made for hands on practice for student to develop practical skills for making various structural fabrications like transmission tower, industrial shades, bridges, offshore platform etc. Structural fabrication codes & standard are discussed to make students conversant with them. Thus this course is one of the important courses of the fabrication technology.

2. COMPETENCY (Programme Outcome according to NBA Terminology)

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency:

- **Prepare structural fabrication jobs using different tools, equipment, machinery, accessories and techniques**

3. 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	150
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.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-Topics
UNIT – I **Introduction to Structural Fabrication**	1a. Describe need & importance of Structural fabrications. 1b .Explain classification of structural Fabrications. 1c. Explain sequence of operations in Fabrication works. 1d. Describe applications of structural Fabrications.	1.1 Need, scope & impotence of structural fabrication 1.2 Definition & classification of structural Fabrication as per various criterion like Use, Material etc. 1.3 Sequence of operations for structural fabrication 1.4 Design & drawing room operations 1.5 Shop-floor operations like 1.5.1 Straightening its classification based on various criterion 1.5.2 Cleaning, marking & punching as per drawing 1.5.3 Template shop operations : definition need & importance, classification on various bases. 1.5.4 Laying out operation 1.5.5 Forming & bending of shapes 1.5.6 Assembly & joining operations 1.6 Inspection, Quality control/ Quality assurance & testing of structure 1.7 Coating, painting & finishing 1.8 Shipping & dispatching of item / components / elements of structure 1.9 Application of structural fabrication like transmission tower, factory / industrial shade, ship building & marine structure, transportation bridge for highway / railway, Coaches for railway surface / metro & mono Amusement / water rides, Sports & events stadiums & domes, Construction industries, Vehicle body (bus, trucks, car, etc), space craft (launching station) , military application(tanks, canon etc) Aeronautical (plane, helicopter, etc) Industrial application (material handling, conveyors, crane, etc) 1.10 List of major structural fabrication

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-Topics
		industries in Gujarat & India 1.11 Need attitude & skill require for shop-floor supervisor
UNIT-II **Codes & Standards for Structural Fabrication**	2a. Apply different codes and standards in structural fabrication 2b. Interpret MTC	2.1 Scope, need & importance of codes and standards 2.2 Different structural fabrication codes & standards like BIS – 800, AWS D1.1 , BIS : 226, BIS- 2062 2.3 Role of Third Party Inspection (TPI) agencies in structural fabrication industry 2.4 Material Test Certificate (MTC)
UNIT– III **Structural Fabrication Drawing**	3a. Interpret structural drawing with symbols 3b. Draw simple structural drawing. 3c. Prepare BOM from given structural drawing	3.1 Introduction & symbol used for fabrication structure 3.2 Preparation of drawing: 3.2.1 Principal of drawing 3.2.2 Sequences of drawing 3.2.3 Reproduction of drawing 3.2.4 General notes of drawing 3.2.5 Detail of various parts of structure 3.2.6 Information from structural fabrication drawing reading 3.3 Specification for erection of steel structure 3.4 Structural set-up & fit-up of pipe, angle, I – sec, T-sec etc.
UNIT– IV **Materials for structural fabrication**	4a. Select commercial forms of metal for given structural application 4b. Estimate material cost of simple jobs. 4c. Prepare simple geometrical construction for marking. 4d. Describe colour code of	4.1 Introduction 4.2 Classification of material 4.3 Structural steels like BIS-226, 2062, BIS-1977-1975, st-32,42,55,58 4.4 Definition & classification of steel 4.5 Advantages of steels over other material 4.6 Properties of structural 4.7 Commercial form of metals 4.8 Weight & material cost calculation of different commercial forms of metals by standard tables and calculations 4.9 Care during storage & handling of material 4.10 Colour coding for identification of

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-Topics
	material used in structural fabrication industries.	material & care during stacking of material 4.11 Geometrical construction used for marking of large size jobs 4.12 Estimation of simple structural job
UNIT– V **Structural Joining Process**	5a. Describe different structural joining processes 5b. Prepare various structural joints	5.1 Introduction 5.2 Classification of joining process 5.3 Selection criteria of joining process 5.4 Mechanical joining process Fasteners and its classification as per BIS 5.5 Thermal joining process (welding, brazing, soldering) 5.6 Special methods (adhesive bonding etc.) 5.7 Comparison of joining process
UNIT– VI **Tools, Equipment, Machinery & Accessories for Fabrication**	6a. Describe the application of various tools, equipment, accessories and machinery for fabrication structural Work.	6.1 Introduction 6.2 Classification of tools, equipment, accessories & machineries used for structural fabrication 6.3 Levelling & alignment tools, method of levelling & alimenting erection types of levelling (vertical, horizontal, angular) 6.4 Marking & measuring tools 6.5 Work holding tools 6.6 Finishing tools/fitting & filing operations 6.7 Power / portable tools 6.8 Miscellaneous tools
UNIT-VII **Cutting Methods and Tools**	7a. Describe different Metal cutting methods 7b. Prepare jobs for fabrication by cutting metals 7c. Describe safety consciousness in metal cutting shop	7.1 Introduction, classification, equipment, procedure, advantages & limitation following cutting process 7.1.1 Mechanical cutting process used in Structural fabrication like shearing, sawing 7.1.2 Thermal cutting process like oxy fuel, plasma cutting, Electric arc cutting and gauging 7.1.3 Non conventional cutting process like

Unit	**Major Learning Outcomes** (Course Outcomes in Cognitive Domain according to NBA terminology)	**Topics and Sub-Topics**
		water Jet cutting, Abrasive water jet cutting, Laser cutting 7.2 Safety in cutting shop
UNIT-VIII **Inspection, Testing & Quality Control in Structural Fabrication**	8a. Describe different types of inspection in structural fabrication job. 8b. Describe skill, attitude & knowledge for inspector/supervisor 8c. Prepare inspection Dossier.	8.1 Introduction, need and types of inspection 8.2 Stages of inspection in structural job (pre, in process, final) 8.3 Role/ function of QC department 8.4 Inspection documentation 8.5 Specification of structural parts 8.6 Applicable tolerance & deviation in structural simple job
UNIT-IX **Erection Procedure & Techniques**	9a. Describe erection procedure for simple structures 9b. Describe use of different tools/ accessories for erection work 9c. Describe use of material handling equipment & accessories 9d. Calculate ladder angle & length required for erection work.	9.1 Introduction & definition of erection 9.2 erection planning work 9.3 erection tackles & false work (types / classification, material handling, lifting device & their accessories) 9.4 Preparatory work at erection site & their Important consideration 9.5 Precaution / safety at erection site 9.6 Erection tools / equipment / machinery / accessories 9.7 Typical procedure of setting out the structure mast / structural lattice girder / column / multi-storeyed building, portal frame. 9.9 Foundation : bedding & grouting work for structure 9.10 Lining, levelling & plumbing of erected structure 9.11 Procedure for quality in erection

5. 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	Introduction to Structural Fabrication	04	02	02	00	04
2	Codes & Standards for Structural Fabrication	04	02	02	02	06
3	Structural Fabrication Drawing	04	02	02	02	06
4	Material for Structural Fabrication	06	03	02	02	07
5	Structural Joining Process	06	02	02	03	07
6	Tools, Equipment, machinery & Accessories for Fabrication	08	02	04	04	10
7	Cutting Methods and Tools	08	02	04	04	10
8	Inspection Testing & Quality Control in Structural Fabrication	08	02	04	04	10
9	Erection Procedure & Techniques	08	02	04	04	10
	Total	**56**	**19**	**26**	**25**	**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.

6. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills **(Course 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 Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx hours required
1	VI	Do marking for a given job as per drawing using measuring instruments.	04
2	VI	Demonstrate working of power and portable tools	02
3	VI	Demonstration use of work holding tools	02
4	VI	Level and align structure by using sprit level/water tube, plumb bob etc	04
5	VI	Demonstrate various types of mechanical and thermal cutting processes	04
6	VII	Demonstrate air arc gauging in electrical arc cutting	02
7	V	Prepare a structural joint by mechanical fastening	04
8	V	Prepare a structural joint by welded joint	04
9	I,III,V,VI	Prepare a job of a square frame cutting at 90^o	04
10	I,III,V,VI	Prepare a job of a square frame cutting at 45^o	04
Total			34

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities:

a. 7.1 Prepare a report on general procedural steps of structure fabrication
b. 7.2 Prepare a report on BIS 800
c. 7.3 Prepare a report on AWS D1.1
d. 7.4 Prepare a report on BIS 226 and BIS 2062
e. 7.5 Prepare a report on TPI
f. 7.6 Prepare a report on MTC
g. 7.7 Prepare a sketchbook of structural drawing, set-up & fit-up, geometrical construction,
h. Mensuration, material cost calculation, ladder height and angle calculation, commercial
i. forms of metals in chart form
j. 7.8 Prepare a report on various departments of structural fabrication industry
k. 7.9 Prepare a report on material handling tools, equipment and accessories

08. SPECIAL INSTRUCTIONAL STRETAGIES (If Any)

i. Arrange a visit to nearby industry where different types of structures are being fabricated.

ii. Show video/animation films showing different manufacturing procedures used in fabrication of structures.

09. SUGGESTED LEARNING RESOURCES

A. List of Books

S No	Author	Title Of Books	Publication
1	Structural Steel Fabrication Erection	S.K. Saxena R.B. Asthana	Somaiya. Latest edition
2	Structural Steel Drafting & Detailing	R.B. Asthana R.B. Shivagunde	Somaiya. Latest edition
3	Westermann Tables	Jutz & Eduard Scharkus	New Age International Edited By Hermann, Latest edition
4	Metal Table		
5	Welding & Welding Technology	Richard L Little	International Tata Mc Hill Co. New Delhi, Latest edition
6	Welders/Fitters Guide	John P Stewart	D.B. Taraporewala Sons & Co. Pvt Ltd. Latest edition
7	Basic Welding & Fabrication	W.Kenyon	
8	Welding Science & Technology	Md. Ibrahim Khan	New Age International , Latest edition
9	Industrial Maintenance	H.P.Gorg	S. Chand, Latest edition
10	Material Handling Application	Doliphont Haynes	Modern Asia Editions, Latest edition
11	Welder Trade Theory	Government Of India	National Instructional Media Institute, Chennai Add. Post Box 3142, Cti Campus, Guindy, Chennai-600032
12	Industrial Engineering & Management	O.P.Khanna	Dhanpat Rai & Sons Publication. Latest edition
13	Basic Sheet Metal Practice	J.W. Giachino	D. Van Nostrand Company, Inc., Latest edition
14	Production Technology vol-1&2	O.P.Khanna	Dhanpat Rai & Sons Publication. Latest edition

B. List of Major Equipment/ Instrument

i. Oxy-fuel gas cutting equipment
ii. Plasma arc cutting equipment
iii. Air arc gauging equipment
iv. Sawing machine
v. Shearing machine
vi. Welding transformer / rectifier
vii. Drilling machine
viii. Portable hand tools / power tools
ix. Marking and measuring instruments
x. Levelling and alignment tools / equipment
xi. Work holding tools / equipment
xii. Material handling tools/ equipments / accessories

C. **List of Software/Learning Websites**

i.http://www.ee.columbia.edu/~bbathula/courses/SSDT/lect14.pdf
ii.http://mercury.kau.ac.kr/welding/Welding%20Technology%20I%20-%20Welding%20Processes/Chapter%2012%20-%20Thermal%20Cutting.pdf
iii.http://www.engineeringtoolbox.com/pipes-codes-standards-t_17.html
iv.https://www.asme.org/about-asme/who-we-are/standards/safety-codes-for-elevators-and-escalators
v.https://en.wikipedia.org/wiki/Industrial_engineering

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. P. B. Pathak,** I/C HOD, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. B. K. Gandhi,** Sr. Lecturer, Dept of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. S.Y. Merchant,** Sr. Lecturer, Dept 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
- **Dr. C. K. Chugh**, Professor, Department of Mechanical engineering