GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester - III

Course Title: **Fabrication Technology-1**
(Course Code: 4335504)

Diploma programmer in which this course is offered	Semester in which offered
Fabrication Technology	Third

1. RATIONALE

This course mainly focus on one of the important areas of fabrication technology i.e., structural fabrication. Student can aware about different codes and standards used in structural fabrication industry. Student will develop capability to read and interpret structural fabrication drawing. Hands on practice in laboratory develops skill in the student for preparing various structural fabrication joints. Student can select and use appropriate cutting and joining methods. This course not only make student employable but entrepreneur also. He / She will be capable for calculating material cost of various commercial forms used in structure. The safe working procedure used in laboratory develops safety consciousness among students, which requires in structural fabrication industry.

2. COMPETENCY

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:

- **Read and interpret structural fabrication drawing.**
- **Prepare structural fabrication jobs using different tools, equipment, machinery and techniques.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Describe importance of structural fabrication and codes & standards used for it.
b) Interpret structural fabrication drawing.
c) Estimate the cost of given structural job.
d) Prepare a job with given specification by selecting appropriate cutting and joining operations.
e) Select the appropriate tools & equipment required for given structural fabrication job.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***CA*** *- Continuous Assessment;* ***ESE*** *-End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. *These PrOs need to be attained to achieve COs.*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Draw typical layout of structural fabrication industry.	1	02
2	Demonstrate various personal protective equipment with safe operating procedure for structural fabrication work.	4	02
3	Draw and interpret given structural fabrication drawing.	2	02
4	Demonstrate various tools & equipments used for structural fabrication work.	5	02
5	Prepare a structural fit up-set up job using various commercial forms of metal as per given sketch. (Marking, Cutting, Filing/finishing, fit up Set up, Tack welding etc.)	2,4,5	06
6	Prepare a structural fabrication job as per given drawing. (Marking, Cutting, Filing/finishing, Fit up-set up, Tack welding etc.)	2,4,5	04
7	Perform oxy-fuel cutting process used for structural fabrication.	4	02
8	Perform air arc gauging process used for structural fabrication work.	4	02
9	Prepare a structural fabrication job using mechanical fasteners. (Marking, Cutting, Filing/finishing, fit up Set up, Drilling, Bolting etc.)	2,4,5	04
10	Estimate cost of material used in structural fabrication work.	3	02
	TOTAL HRS.		**28**

Note

i. More ***Practical Exercises*** *can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. Boiler suit, safety shoes & other safety items are compulsory while attending laboratory and has to be brought by students. (annexure-1)

The following are some sample 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed Practical Exercises of this course required which are embedded in the COs and ultimately the competency.

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
For PrOs no: 1 & 3		
1	Knowledge.	20
2	Drawing Layout, Planning & Scale	20
3	Neatness & completeness	30
4	Dimensions (accuracy)	20
5	Punctuality	10
Total		**100**

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
For PrOs no: 2,4,5,6,7,8,9		
1	Knowledge of experiment	20
2	Performance	30
3	Procedure followed	30
4	Quality of report	10
5	Punctuality	10
Total		**100**

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
For PrOs no: 10		
1	Knowledge of experiment	30
2	Quality of report	30
3	Participation	20
4	Punctuality	10
5	Originality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Hand gloves, Welding face guard, Safety goggles, Hand sleeve, Leg guard etc.	4,5,6,7,8,9
2.	Steel tape, Steel rule, Drawing set, Protractor etc.	1 to 10
3.	Portable drill machine, angle grinder, Pillar drill machine, Die	4,5,6,8,9

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
	grinder, Power hacksaw machine, Straight grinder, Drill bits, Portable cutting machine.	
4.	Tri square, Scriber, Hacksaw blade & frame, Flat files, Hand files, Half round file, Triangular file, Rough files, Smooth files, Bevel protractor, Hammer, Chisels, Bench vice, C-clamp, Welding machine (rectifier), Power cable, Earthing clamp, Electrode holder, SMAW electrodes, chisels, Wire brush, Chipping hammer, Inside caliper, Outside caliper, Odd leg caliper, Fix spanners, Ring spanner, Adjustable spanner, Plyer, Lock Plyer, Adjustable plyer, Vice grip plyer, Combination plyer, Elen keys, Wedges, Compass, Divider, Spirit level, Taung tester etc.	4,5,6,7,8,9
5.	Oxygen cylinder, Acetylene cylinder, Oxygen cylinder regulator, Acetylene cylinder regulator, Hose pipe, Oxy fuel cutting torch, Ignitor, Back fire arrestor etc.	7
6.	Welding power source, Compressor, gouging holder, Gouging electrode etc.	8
7.	Weighing scale etc.	10

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Follow safety practices in laboratory.
b) Practice good housekeeping.
c) Work as a leader/a team member.
d) Maintain tools/equipment
e) Follow ethical practices

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year & 4th year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for *development* of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit-I Introduction to Structural Fabrication	1a. Describe need & Importance of structural fabrications. 1b. Classify structural fabrications. 1c. Describe sequence of operations in fabrication works. 1d. Describe applications of structural fabrications. 1e. Describe importance of different codes and standards in structural fabrication	1.1 Need, scope & importance, layout of structural fabrication industry. 1.2 Definition & classification of structural fabrication. 1.3 List & function of structural fabrication processes/operations 1.4 Application of structural fabrication. 1.5 Scope, need & importance of codes and standards. 1.6 Importance and introduction of structural fabrication codes & standards like BIS – 800, AWS D1.1, BIS: 226, BIS- 2062. 1.7 Role of Third-Party Inspection (TPI) agencies in structural fabrication industry. 1.8 Need attitude & skill require for shop-floor supervisor.
UNIT– II Structural fabrication drawing and materials	2a. Interpret structural fabrication drawing. 2b. Draw various types of fit up-set ups for structural fabrication. 2c. Describe pre-engineered building for structural fabrication. 2d. Prepare different structural fabrication fit up & set ups. 2e. Interpret material test certificate (MTC)	2.1 Introduction of structural fabrication drawing. 2.2 Types of structural fabrication drawing. 2.3 General notes & bill of material in GA drawing. 2.4 Introduction of pre-engineered building (PEB) 2.5 Detailing of structures, terminology/ various parts used in structural fabrication drawing. 2.6 Various types of joints & fit up-set up. 2.7 Typical members of industrial buildings & roof truss. 2.8 Welding symbols represented in structural drawing. 2.9 Symbols for fasteners used for structural fabrication. 2.10 Structural fabrication general arrangement drawing. 2.11 Structural fabrication detailed drawing. 2.12 Introduction, classification, advantages of structural steel. 2.13 Commercially available forms/profile sections of metals. 2.14 Material Test Certificate (MTC)
UNIT– III Structural fabrication	3a. Measure and converts different units 3b. Estimate material cost of	3.1 Definition and unit conversion of Area, Volume, Density, Mass, Weight. 3.2 Problems related to Area, Volume,

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
calculation & marking	different commercial forms used in structural fabrication. 3c. Use trigonometric & geometric functions for structural fabrication marking.	Mass & Weight. 3.3 Use of different mensuration formulas. 3.4 Cost estimation of structural job. 3.5 Trigonometry function and related exercise/calculation for structural fabrication 3.6 Geometrical construction used for marking of large size jobs
UNIT– IV Structural cutting and Joining Processes	4a. Describe different metal cutting methods. 4b. Classify joining processes. 4c. Prepare various structural Joints. 4d. Describe safe operating procedure for cutting shop.	4.1 Introduction and Classification of cutting processes used in structural fabrication. 4.2 Working principle, setup sketch, advantages, disadvantages and application for: 4.2.1 Sawing (Manual/hacksaw machine /bandsaw machine) 4.2.2 Shearing 4.2.3 Oxy fuel cutting 4.2.4 Air arc gouging 4.3 Introduction of joining process 4.4 Classification of joining process 4.5 Selection of joining method. 4.6 Introduction, types, terminology, process, advantages and dis advantages of riveted joints. 4.7 Introduction, types, terminology, process, advantages and dis advantages of bolted joints. 4.8 Safety in cutting shop.
Unit -V Tools, Equipment, machinery & accessories for fabrication	5a. Identify tools/equipment's used for structural fabrication work. 5b. Classify various tools, equipment, accessories and machinery for structural fabrication work. 5c. Describe the application of various tools, equipment, and machinery for structural fabrication work. 5d. Select proper tools & equipment's for structural fabrication process.	5.1 Introduction 5.2 Classification of tools, equipment, accessories & machineries used for structural fabrication. 5.3 Work holding tools. 5.4 Marking and measuring tools 5.5 Cutting tools. 5.6 Finishing/fitting tools. 5.7 Power, portable and other tools. 5.8 Machineries & various accessories used for structural fabrication.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to structural fabrication.	8	4	7	0	11
II	Structural fabrication drawing and materials.	10	6	7	4	17
III	Structural fabrication calculation & marking.	8	3	0	11	14
IV	Structural cutting and joining processes.	8	3	7	4	14
V	Tools, equipment, machinery & accessories for fabrication.	8	3	7	4	14
	TOTAL	**42**	**19**	**28**	**23**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note: *This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks and marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports/charts for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Prepare solutions of different assignments given by subject faculty.
b) Prepare a list of specifications for various tools/equipment/machines used in the structural fabrication work.
c) Visit the local metal trader/fabricator and collect all relevant information and prepare the detailed report.
d) Undertake a market survey of local dealers for procurement of commercial forms of metal.
e) Download videos showing correct practices for marking, cutting & fit up set up for structural fabrication.
f) Student will visit the respective discipline industry/site and will prepare the list of structural fabrication related equipment/machineries used in that industry/site.
g) Collect some industrial structural component, identify type of commercial form used in it.
h) Collect videos, animation showing structural fabrication.
i) Prepare power point presentation on structural fabrication marking & cutting process.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4*** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Arrange visit to nearby industries and workshops or use of videos/animations for understanding various fabrication processes.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and eighth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14-16** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a. Prepare charts of different commercial forms of metal as per standards.
b. Draw different joints used for structural fabrication.
c. Prepare chart of illustration of welding symbols.
d. Prepare typical industrial building/shed drawing.
e. Prepare special tools/projects used for fabrication.
f. Prepare report on PEB.
g. Prepare chart regarding safety precautions for structural fabrication.
h. Prepare report on oxy fuel & plasma cutting processes.
i. Select a structural fabrication product (approved by subject teacher) and prepare list of tools and equipments required to manufacture it.
j. Prepare report using different books, technical magazine, journals etc. on the topic given by the subject teacher within the syllabus or beyond the syllabus.
k. prepare his/her video on demonstrating different fit up set up, cutting process, joining process etc. given by the subject teacher.
l. Collect some brochure of tools/equipments used for fabrication from local/online vendors.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Structural Steel Fabrication and Erection	S.K. Saxena R.B. Asthana	Somaiya. Latest edition ISBN: 81-7039-207-1
2	Structural Steel Drafting & Detailing	R.B. Asthana R.B. Shivagunde	Somaiya. Latest edition
3	Westerman Tables	Jutz & Eduard Scharkus	New Age International Edited By Hermann, Latest edition
4	Welders/Fitters Guide	John P Stewart	D.B. Taraporewala Sons & Co. Pvt Ltd. Latest edition
5	Workshop calculation & science 1ST Year	-	National instructional media institute, Chennai
6	Workshop calculation & science 2nd Year	-	National instructional media institute, Chennai
7	Basic Welding & Fabrication	W.Kenyon	Pitman publishing limited ISBN: 0273013211
8	Welding technology	O.P. Khanna	Dhanpatrai publications (p) ltd.
9	Thick Plate/structural steel working-1	EITB	Engineering industry training board Isbn:0 85083 025 7 Isbn:0 85083 531 3
10	Engineering Drawing Practices for School and Colleges SP 46:2003	Bureau of Indian Standards	Bureau of Indian Standards, Government of India, Third Reprint, October 1998; ISBN:. 81-7061-091-2
11	Basic Sheet Metal Practice	J.W. Giachino	D. Van Nostrand Company, Inc., Latest edition
12	Production Technology vol-1&2	O.P.Khanna	Dhanpat Rai & Sons Publication. Latest edition
13	Basic Welding & Fabrication	W.Kenyon	-
14	Welding Science & Technology	Md. Ibrahim Khan	New Age International , Latest edition

14. SOFTWARE/LEARNING WEBSITES

- https://fabricatorguide.com/
- https://www.steelconstruction.info/Fabrication
- https://mbphenix.com/
- https://primesourceco.com/latest-news/guide-to-metal-fabrication/
- http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf
- http://www.weldingtechnology.org

- http://www.newagepublishers.com/samplechapter/001469.pdf
- https://nptel.ac.in/courses/112/103/112103305/
- https://nptel.ac.in/courses/113/106/113106087/
- https://www.youtube.com/watch?v=mX1zpbDva-w
- https://www.youtube.com/watch?v=9-yd1QGwng4

15. PO-COMPETENCY-CO MAPPING

Semester II	Fabrication Technology-1 (Course Code: 4335504)						
	POs						
Competency & Course Outcomes	**PO 1 Basic & Discipline specific knowledge**	**PO 2 Problem Analysis**	**PO 3 Design/ develop-ment of solutions**	**PO 4 Engineering Tools, Experimen-tation & Testing**	**PO 5 Engineering practices for society, sustainability & environment**	**PO 6 Project Manage-ment**	**PO 7 Life-long learning**
Competency	• **Read and interpret structural fabrication drawing.** • **Prepare structural fabrication jobs using different tools, equipment, machinery and techniques.**						
Course Outcomes **CO 1)** Describe importance of structural fabrication and codes & standards used for it.	3	1	-	-	-	-	-
CO 2) Interpret structural fabrication drawing.	3	2	-	-	-	-	2
CO 3) Estimate the cost of given structural job.	3	2	-	-	-	-	2
CO 4) Prepare a job with given specification by selecting appropriate cutting and joining operations.	3	2	-	2	1	-	2
CO 5) Select the appropriate tools & equipment required for given structural fabrication job.	3	2	-	3	-	-	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1.	Mr. Ashoksinh M. Gohil	Sir Bhavsinhji Polytechnic Institute Bhavnagar	9924682010	amgohilges@gmail.com
2.	Mr. Nilesh M. Bhangale	Sir Bhavsinhji Polytechnic Institute Bhavnagar	9016926792	nmbhangale@gmail.com

ANNEXURE-1

❖ SAMPLE SEFTY CONTRACT:

(To be filled by the students and submitted to concerned faculty/staff)

-- Use for reference purposes only --

1. You have to read and sign the safety contract.
2. The safety contract says that you understand that safety is your responsibility.
3. The safety contract to be signed before you carry out any work in the laboratory and if you don't observe and obey the safety rules, you will not be allowed in the laboratory.

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Safety Contract

Date: _______________

Name of Institute: ____

Name of Course with Code: Fabrication Technology-1 (4335504)

Name of Faculty/Staff with Designation: 1. ____

2. ____

3. ____

I RECOGNIZE THAT:

1. Safety is my responsibility while using a any tool or equipment.
2. Safety regulations have been provided to me.
3. The possibility of accident and injury increases if I do not follow all the safety guidelines.
4. I must act responsibly to ensure my own safety & the safety of others in the work area.

I AGREE TO:

1. Never work in the shop without my faculty's/instructor's supervision.
2. Read and practice all the safety regulations that have been distributed to me in this course or have been posted in the work areas.
3. Act in a responsible manner at all times in the laboratory.
4. Follow all instructions given by the faculty.
5. Immediately report any unsafe condition or activity to my faculty.
6. Wear eye protection at all times when working with tools or working anywhere near someone who is using tools.
8. Cut or Tie back long hair, remove jewellery, secure loosed clothing, and wear boiler suit & safety shoes in the laboratory.
9. Clean all work areas and put equipment away before leaving the laboratory.

I, ____, have read and agree with all the safety instructions.

Particulars:

Programme: _______________________ Student Signature

Batch No.: _______________________ __________________________

Enrollment No.: ___________________