GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: FABRICATION DESIGN
(COURSE CODE: 3355501)

Diploma Programme in which this course is offered	Semester in which offered
Fabrication Technology	5th Semester

1. RATIONALE

Fabrication is one of the major manufacturing processes which is extensively used in producing process equipments, steel structures and piping projects. This course develops capability to interpret and draft fabrication design drawings using basic knowledge and skill attained through this course. The students will be able to apply this knowledge and skill in their real life application throughout their carrier in the world of work.

2. LIST OF COMPETENCY

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

- **Design simple machine parts such as riveted joints, welded joints, pressure vessels and steel structures.**

3. COURSE OUTCOMES

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

i. Explain general considerations in machine design
ii. Determine different types of stresses in different load conditions in simple machine parts.
iii. Design simple riveted jointed
iv. Design simple welded joints
v. Design simple steel structures.
vi. Explain basic considerations in process equipment design
vii. Design simple steel structures

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	150
4	0	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. COURSE CONTENT DETAIL

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Introduction to Machine Design**	1a Describe general design consideration in machine design 1b Convert fundamental unit in various system 1c Classify machine design	***INTRODUCTION TO MACHINE DESIGN:*** 1.1 Definition 1.2 Classification of machine design 1.3 General considerations in machine design 1.4 General procedure in machine design 1.5 Fundamental units & its conversion
Unit -II **Simple Stresses in Machine Parts / Process Equipment**	2a. Calculate stress & strain for given job 2b. State the factors of safety and its selection criteria 2c. State the relation between - bulk modulus and young's modulus, young's modulus and modulus of rigidity in thermal stress 2d. Explain application of principle stress in designing of machine parts. 2e. Explain effect of different factors on endurance limit. 2f. Explain meaning of stress concentration and describe methods to reduce it. 2g. Describe importance of factor of safety and its selection criteria.	***SIMPLE STRESSES IN MACHINE PARTS / PROCESS EQUIPMENT:*** 2.1Load, Stress, Strain 2.2Tensile, compressive & shear stress & strain 2.3Young's modulus 2.4Shear modulus 2.5Bearing stress 2.6Stress strain diagram 2.7Working stress 2.8Factor of safety and its selection criteria 2.9Thermal stress 2.10 Linear and lateral strain 2.11 Poisson's ratio 2.12 Volumetric strain 2.13 Bulk modulus 2.14 Relation between bulk modulus and young's modulus 2.15 Relation between young's modulus and modulus of rigidity 2.16 Impact stress 2.17 Resilience 2.18 Torsional shear stress 2.19 Bending stress 2.20 Principal stress and principal plane 2.21 Application of principal stress in designing machine members 2.22 Cyclic stresses 2.23 Fatigue and endurance limit 2.24 Effect of different factors on endurance limit 2.25 Stress concentration & methods of reducing stress concentration 2.26 Notch sensitivity 2.27

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-III Design of Riveted Joints	3a. Calculate strength and efficiency of various types of riveted joint 3b. State Essential qualities of rivet 3c. State types of rivets and riveted joint 3d. Explain failures of a riveted joint 3e. Design simple riveted joints.	***DESIGN OF RIVETED JOINTS:*** 3.1 Introduction & methods of riveting 3.2 Material of rivet 3.3 Essential qualities of rivet 3.4 Types of rivets 3.5 Types of riveted joint 3.6 Important terms used in riveted joint 3.7 Failures of a riveted joint 3.8 Strength of riveted joint 3.9 Efficiency of riveted joint 3.10 Riveted joint for structural use – joint of uniform strength (Lozenge joint)
Unit-IV Design of Welded Joints	4a.Calculate strength of various types of welded joint 4b. Compare riveted joints with welded joints 4c. Design axially loaded unsymmetrical welded section	***DESIGN OF WELDED JOINTS:*** 4.1Introduction 4.2Advantages and disadvantages of welded joint over riveted joint 4.3Types of welded joint 4.4Strength of transverse fillet welded joint 4.5 Strength of parallel fillet welded joint 4.6 Special cases of fillet welded joint 4.7 Strength of butt welded joint 4.8 Stresses for welded joint 4.9 Stress concentration factor for welded joint 4.10 Axially loaded unsymmetrical welded sections
Unit-V Basic Consideration in Process Equipment Design	5a. Calculate thickness of pressure vessel shell as per ASME sec VIII div 1 5b. Calculate thickness of various types of dished end as per ASME Sec VIII Div-1 5c. Describe failure in pressure vessel 5d. Describe design consideration of various parts of pressure vessel 5e. Design simple pressure vessels for given requirement.	**BASIC CONSIDERATION IN PROCESS EQUIPMENT DESIGN** 5.1 Design codes 5.2 Factors affecting process equipment design 5.3 Maximum working pressure 5.4 Design pressure 5.5 Design temperature 5.6 Design stress & factor of safety 5.7 Corrosion allowance 5.8 Weld joint efficiency factor 5.9 Design loadings 5.10 Stress concentration 5.11 Thermal stress 5.12 Criteria of failure 5.13 Failures in pressure vessel 5.14 Cylindrical shell design 5.15 Design of heads & closures 5.16 Compensation for opening in

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		process equipment 5.17 Types & design criteria of flange 5.18 Gasket & its selection 5.19 Design consideration & types of support for pressure vessel
Unit-VI Design Of Structure	6a. Describe design consideration of different types of structure 6b. Calculate SF & BM diagram for cantilever and simply supported beam for point load and uniformly distributed load 6c. Draw bending moment and shear force diagrams for given load conditions. 6d. Design simple steel bridges, transmission line towers and roof trusses for given requirement	***DESIGN OF STRUCTURE:*** 6.1 Factors governing structural layout 6.2 Structural design 6.3 Steps in design 6.4 Load analysis 6.5 Minimum thickness 6.6 Plans and drawings 6.7 Design considerations 6.8 Methods of structural design 6.9 Simple design 6.10 Semi-rigid design 6.11 Fully rigid design 6.12 Experimentally based design 6.13 Slenderness ratio 6.14 Corrosion protection 6.15 Increase of stresses 6.16 Fluctuation of stresses 6.17 Resistance to horizontal forces 6.18 Stability of the structure 6.19 Industrial building 6.20 Steel Bridges 6.21 Web stiffeners & its types 6.22 Roof trusses 6.23 Transmission line tower 6.24 Bending moment & shear force diagram 6.25 Cantilever beam with point load at end 6.26 Cantilever beam with uniformly distributed load 6.27 Simply supported beam with point load at mid point 6.28 Simply supported beam with uniformly distributed load

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
I	Introduction to Machine Design	6	3	4	0	07
II	Simple Stresses in Machine Parts / Process Equipment	18	8	7	8	23
III	Design of Riveted Joints	6	0	4	4	08
IV	Design of Welded Joints	6	0	4	4	08
V	Basic Consideration in Process Equipment Design	12	4	6	4	14
VI	Design of Structure	8	0	4	6	10
	Total	**56**	**15**	**29**	**26**	**70**

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

NOTE :-

Suggested specification table shall be treated as only general guidance for students and teachers. The actual distribution of marks in the question paper may vary from above table.

7. SUGGESTED LIST OF EXERCISE/PRACTICAL/EXPERIMENTS

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 mainly 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

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S. No.	Unit No.	Practical Exercises (Outcomes in cognitive and psychomotor domain)	Approx Hours
1	5	Interpret process equipment drawing.	2
2	5	Draw process equipment drawing on AutoCAD – 2D.	2
3	2	Calculate stress & strain for given load and job conditions.	2
4	3	Design simple riveted joints.	2
5	4	Design simple welded joint.	2
6	5	Interpret ASME Sec – VIII div-1.	2
7	5	Interpret Design consideration of pressure vessel as per ASME Sec-VIII- Div -1	4

8	6	Interpret Design consideration of Industrial Shade.	2
9	6	Interpret Design consideration of Transmission Line Tower	2
10	6	Interpret Design consideration of Industrial building	2
11	6	Interpret Design consideration of Roof struts	2
12	6	Interpret Design consideration of Steel bridge	2
13	6	Draw S.F & B.M diagram for cantilever & simple supported beam and calculate the SF and BM.	2
		Total	**28**

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities:

i. Solve as many examples as possible from different books.
ii. Prepare drawing of different designs and maintain the design book

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

i. Give as many design/numerical problems to students as possible and help them whenever they are stuck.
ii. Identify students in three groups namely below average, average and bright students and give the problems according to their ability. This would give students a challenge which they can overcome and would also create interest in solving problems. This would also help in reduction of incidences of copying.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Title of Books	Author	Publication
1	A text book of machine design	R. S. Khurmi J. K Gupta	Euresia Publishing House (Pvt.) Ltd.
2	Pressure Vessel Design manual	Deniss Moss	Gulf professional publishing
3	Design and Analysis of Steel structures	V.N.Vazirani M.M.Ratwani Honey Mehra	Khanna Publishers
4	Chemical equipment design	B.C.Bhattacharya	CBS Publishers & Distributers
5	Process Equipment Design	V.V.Mahajani S. B. Umreji	Macmillan Publication
6	Pressure vessel design – Guide & procedure	Mr. Ghader Ghanbari Mr. Mohammad Ali Liaghat	
7	Strength of material	R.S.Khurmi	S.Cchand & Company (Pvt.) ltd

B. List of Major Equipment/ Instrument

i. Computer Systems

C. List of Software/Learning Websites

i. Microsoft excel
ii. AutoCAD
iii. ProE
iv. Catia V

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. P. B. Pathak,** I/C HOD**,** Deptt. of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. B. K. Gandhi,** Sr. Lecturer, Deptt. of Fabrication Technology, Sir B.P.I., Bhavnagar
- **Prof. S. Y .Merchant**, Sr. Lecturer, Deptt. of Fabrication Technology, Sir B.P.I., Bhavnagar

Co-coordinator and Faculty Members from NITTTR Bhopal

- **Dr. A. K. Sarathe,** Associate Professor Deptt. of Mechanical Engineering,
- **Dr. C. K. Chugh**, Professor Deptt. of Mechanical Engineering,