GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: ADVANCED STRUCTURE
(COURSE CODE: 3355003)

Diploma Programme in which this course is offered	Semester in which offered
Architectural Assistantship	5th Semester

1. RATIONALE

Understanding of the concept of mechanics of deformable bodies is very essential and important for the students in order to make them familiar with the response of different basic structural elements under various types of loading. In this course, elementary knowledge of R.C.C. and Steel structures is introduced so that students will be able to understand the basic reinforcement detailing, different rolled steel sections and their connections, load carrying capacity of column, moment of inertia and stresses in beams.

2. LIST OF COMPETENCY

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

- **Explain structural design methods with factors affecting stress and measures to improve ability of different structural members to withstand these stresses.**
- **Draw the reinforcement detail of the structural component like slab, beam, column and column footing.**

3. COURSE OUTCOMES

The theory should be taught and lab practice 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 simple stress and strain and Hook's law.
ii. Explain and Compute moment of inertia of solid sections like rectangle, circle, I-section and T-section.
iii. Explain the concept of bending stress and calculate bending stress.
iv. Calculate load carrying capacity of column.
v. Analyse Statically Determinate structures like Beam, Column
vi. Explain structural design methods and properties of concrete and steel.
vii. Draw reinforcement detail of structural member
viii. Draw various steel sections and their connections.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	S/P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

Legends: L-Lecture; **T-** Tutorial/Teacher guided theory Practice**, S**-Studio; **P** - Practical; **C** – Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in Cognitive domain)	Topics and Sub-topics
Unit – I Simple stress and strain	1a. State Types of Stress and Strain 1b. Explain stress, strain, shear stress and shear strain 1c. Describe Hook's law 1d. Define elastic constants, Modular ratio, volumetric strain 1e. Compute stress and strain for bars of varying section and composite section	1.1.1 Types of Stress and Strain 1.1.2 Definition of shear stress and shear strain 1.1.3 Definition of elastic limit, hook's law and poisson's ratio 1.1.4 Elastic Constants – Modulus of elasticity, modulus of rigidity, bulk modulus 1.1.5 Modular ratio, volumetric strain 1.1.6 Examples on bars of varying
Unit – II Moment of inertia	2a.Describe moment of inertia and its importance 2b. Compute Moment of Inertia	2.1.1 Moment of inertia and its importance 2.2.1 Parallel and perpendicular axis theorem 2.3.1 Formula of moment of inertia of solid sections like rectangle, circle, I-section
Unit – III Stresses in beams	3a. Explain bending stress 3b. Describe the equation of theory of simple bending 3c. Compute bending stress	3.1.1 Bending stress, neutral axis, section modulus, moment of resistance 3.1.2 Equation of theory of simple bending 3.2.1 Examples of bending stress diagrams for rectangle, circle, I-section, T-section
Unit – IV Column and strut	4a.Define column and strut 4b. Define short column and long column 4c. Calculate load carrying capacity of column and strut using Euler's formula.	4.1.1 Column and strut 4.1.2 Short and long column 4.1.3 End condition of column 4.1.4 Effective length of column 4.1.5 Assumptions of Euler's formula 4.1.6 Euler's crippling load
Unit – V Elements of structural design	5a. Compare working stress method and limit state method 5b. Explain the properties of concrete and steel 5c. Classify different types of loads	5.1.1 Working stress method 5.1.2 Limit state method 5.1.3 Assumptions of R.C.C. design (limit state) 5.2.1 Properties of concrete 5.2.2 Various grades of cement and concrete 5.2.3 Various types of reinforcing steel and its importance 5.2.4 Types of load - Dead load, live load, impact load, wind

Unit	Major Learning Outcomes (in Cognitive domain)	Topics and Sub-topics
Unit – VI Reinforcement details of structural component	6a. Draw reinforcement detail of slab, beam, column and column footing	6.1.1 Reinforcement detail of slab – one way, two way, continuous and cantilever 6.2.1 Reinforcement detail of beam – singly reinforced and doubly reinforced, T-beam, L-beam 6.3.1 Reinforcement detail of R.C.C. column and column
Unit – VII Steel sections	7a. Draw various types of rolled steel section 7b. Draw various connections	7.1.1 Types of rolled steel section used in beam and column 7.3 Various methods of connection of steel section – beam to beam at same level,

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (Theory)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I.	Simple stress and strain	10	03	03	10	16
II.	Moment of inertia	04	02	00	05	07
III.	Stresses in beams	06	04	00	06	10
IV.	Column and strut	04	02	02	04	08
V.	Elements of structural design	07	04	02	05	11
VI.	Reinforcement details of structural component	07	00	03	08	11
VII.	Steel sections	04	00	02	05	07
	Total	**42**	**15**	**12**	**43**	**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 EXERCISES/PRACTICALS

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.	Practical/Exercise (In psychomotor domain)	Approx. Hrs. Required

1.	I	Solve 8 problems from unit –I	4
2.	II	Solve 5 problems from unit –II	2
3.	III	Solve 6 problems from unit –III	4
4.	IV	Solve 8 problems from unit –IV	2
5.	VI	Draw reinforcement detail for slabs (Sheet-I)	4
6.	VI	Draw reinforcement detail for beams (Sheet –II)	4
7.	VI	Draw reinforcement detail for column and column footing (Sheet –III)	4
8.	VII	Draw various types of steel section and its joints detail	4
		Total	**28**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

i. Students are suggested to take visit of Strength of Material laboratory to get more familiar with fundamentals of mechanics.
ii. Survey the market and prepare a list of various types of Structural Steel Sections commonly used.
iii. Students are suggested to take visit of at least two sites for reinforcement detail and one railway
station visit for steel design and prepare a report.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. Lectures by field experts, demonstrations,
ii. Video films,
iii. Field/industry visits to explain structural designs and practices used to improve the strength of structural elements.
iv. Visit a Structural Consultant's office to understand structural design and drawings prepared for architectural projects

10. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr. No.	Title of Book/Journals	Author	Publication
1.	Strength of Materials	S. Ramamurtham, R. Narayan	Dhanpat Rai Publishing company (P) Limited
2.	Strength of Materials	Timoshenko	
3.	Strength of Materials	R S Khurmi	S. Chand & Company Limited
4.	Strength of Materials	Dr. B.C. Punmia	Laxmi Publications
5.	Strength of Materials	H J Shah & Junarkar	S. Chand & Company Limited

B. List of Software/Learning Websites

i. nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm
ii. www.freestudy.co.uk/mech%20prin%20h2/stress.pdf
iii. www.engineerstudent.co.uk/stress_and_strain.html
iv. https://www.iit.edu/arc/workshops/pdfs/Moment_Inertia.pdf

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A.T. Jha,** Lecturer in Civil Engineering, Govt. Polytechnic, Vadnagar
- **Prof. Bhruguli H. Gandhi,** Lecturer in Applied Mechanics, Govt. Polytechnic for Girls, Ahmedabad
- **Prof. A.R. Rathod,** Lecturer in Architecture, Govt. Polytechnic, Vadnagar
- **Prof. R.T. Dabhi,** Lecturer in Architecture, Govt. Polytechnic, Vadnagar

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Prof. Dr. J.P.Tegar**, Professor & Head, Department of Civil & Environment Engineering
- **Prof. M. C. Paliwal, Associate Professor,** Department of Civil & Environment Engineering