GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: STRUCTURAL MECHANICS-II (Code: 3340601)

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering	4th Semester

1. RATIONALE

Knowledge and understanding of Structural Mechanics is very important for engineers in order to make Civil Engineering Structures safe and serviceable. The Structural Mechanics –II subject is taught in 4th sem. to develop the concept of analysis of determinate structures under various types of transverse &/or direct loading. Analysis of industrial trusses is also incorporated to give an idea of typical structure to the students. In this course, analysis of indeterminate structures under transverse loading, along with analysis of members under direct loading is to be studied. Analysis of structural members under the effect of principal stresses & strains is also incorporated to give an exposure of compound stresses to the students. At diploma level students are expected to study about these aspects of analysis and design of various structures so as to develop their understanding in order to apply their knowledge in construction industry.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop different types of skills leading to the achievement of following competency:

- **Analyze various types of beams & Evaluate the 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. Analyze various types of statically indeterminate beams.
ii. Compute slope and deflection in statically determinate beams.
iii. Evaluate the structures under direct and eccentric axial loading.

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	
03	00	02	05	70	30	20	30	150

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

5. COURSE DETAILS

Unit	Major Learning Outcomes (in Cognitive Domain)	Topics and Sub-topics
Unit – I **Fixed Beam**	1a. Distinguish between determinate and indeterminate structures 1b. Draw Shear Force & Bending Moment Diagram for Fixed Beams	1.1 Different types of Determinate & Indeterminate Structures & Structural Components/Elements 1.2 Advantages of fixed beam over simply supported beam 1.3 Concept of analysis by Area Moment method 1.4 μ and μ' diagram 1.5 Numerical for SF & BM diagrams for 1.6 fixed beam with central point load &/or 1.7 UDL over Full Span
Unit – II **Slope & Deflection**	2a. Compute deflection & slope induced in Statically Determinate Beams 2b. Draw deflection curve in different types of beams under different loads and support conditions.	2.1 Slope & Deflection 2.2 Formulae of Slope & Deflection for Cantilever Beam subjected to Point Load at free end , point load not at free end and with UDL along full Span 2.3 Formulae of Slope & Deflection for S.S Beam subjected to Central Point Load and with UDL along full Span 2.4 Numerical problems on Slope and Deflection for 2.2 & 2.3
Unit – III **Continuous Beam**	3a. Calculate Shear Force & Bending Moment Diagram for Continuous Beam using Theorem of Three Moment 3b. Draw Shear Force & Bending Moment Diagram for Continuous Beam using Theorem of Three Moment 3c. Draw Shear Force & Bending Moment Diagram for Continuous Beam using Moment Distribution Method	3.1 Statically Indeterminate Beam Like Propped Cantilever , Continuous Beam with or without Over Hang Define Free Moment & Fixed End moment diagrams 3.2 Theorem of Three Moment (Clapeyron's Theorem) 3.3 Formulae to find B.M of a continuous beam using theorem of Three Moment Method 3.4 Point of Contra-flexure & its importance 3.5 Numerical to draw S.F & B.M Diagram for two or three span continuous beams having end supports as overhang , fixed and / or hinge and subjected to Central Point Load and/ or U.D.L over full span using Theorem of Three Moment 3.6 Stiffness, flexibility, carry over Factor & Distribution Factor 3.7 Moment Distribution Method 3.8 Numerical to draw S.F & B.M Diagram of two or three span continuous beams having end supports as overhang , fixed and / or hinge and subjected to Central Point Load and/ or U.D.L over full span using Moment Distribution Method

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – IV Combined Direct & Bending Stresses	4a. Calculate Direct & Bending Stresses of various structural components 4b. Check stability of Retaining wall & Dam 4c. Draw stress distribution diagram in retaining wall and dams under different types of loads	4.1. Eccentricity 4.2. Formula for combined Direct & Bending Stresses 4.3. Limit of Eccentricity 4.4. Core of section for Rectangular & Circular (Hollow & Solid) 4.5. Formulae for combined stresses on sections subjected to eccentric loads considering Uniaxial & Biaxial eccentricity 4.6. Stress distribution diagrams 4.7. Application of concept of combined stresses to find pressure at base & stability check of Retaining Wall & Rectangular & Trapezoidal Dam 4.8. Numerical for 4.6 & 4.7
Unit – V Principle Stresses & Principle Planes	5a. Calculate Principal Stresses & Principal Plane on a plane in a Strained structural Material	5.1 Formulae for Normal , Tangential & Resultant Stresses due to Direct Orthogonal Stresses & Shear Stress 5.2 Numerical based on 5.1 5.3 Formulae for Principal Stresses and for Location of Principal Planes 5.4 Numerical based on 5.3 5.5 Mohr's Circle and its application for 5.1 & 5.3 5.6 Numerical based on 5.1 , 5.3 Graphically

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

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fixed Beam	06	01	02	04	07
II	Slope & Deflection	04	01	02	04	07
III	Continuous Beam	12	04	03	14	21
IV	Combined Direct & Bending Stresses	08	03	04	07	14
V	Principle Stresses & Principle Planes	12	02	05	14	21
Total		**42**	**11**	**16**	**43**	**70**

Legends: R = Remember, U = Understand, A= Apply and above Level (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/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.	Practical/Exercise (outcomes in psychomotor domain)	Approx. Hrs. Required
1	I	Solve at least five real life problems pertaining to Unit – I	02
2	II	Perform Deflection test on a Simply Supported beam with different sectional properties (material, c/s dimensions etc)	02
3	II	Perform Deflection test on a cantilever beam with different sectional properties (material, c/s dimensions etc)	02
4	II	Perform Deflection test on a fixed beam with different sectional properties (material, c/s dimensions etc)	02
5	II	Solve at least three real life problems pertaining to Unit – II	02
6	II I	Solve at least Six real life problems pertaining to Unit-III	06
7	IV	Solve at Least four real life numerical Problems of Unit-IV	04
8	V	Solve at least Eight real life problems pertaining to Unit – V	08
		Total Hours	**28**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

i. Conduct a mini project in which a group of students will practically verify the effect of cross section , end conditions on the deflection of beams .
ii. Site Visit to understand Retaining Wall structure , Dam and indeterminate structures

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

i. Demonstration of Models & Charts of Indeterminate Structures , Dams & retaining wall & field Visits
ii. Show video films/animations to explain failure of various structures under different load conditions.

10. SUGESSTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1.	Strength of Material & Mechanics of Structures	Dr. B C Punamia	Standard Publication
2.	Strength of Material	S RAMAMURTHAN	Dhanpat Rai Publication
3.	Strength of Material	Timo Shanko	Tata Mcgraw Hill
4.	Theory of Structures	R S KHURMI	S Chand
5.	Theory of Structures – vol I & II	S B Junarkar H J Shah	Charotar Publication

B. List of Major Equipment/Materials

1. Cantilever Beam, Fixed & Simply Supported Beam Model to measure deflection

C. List of Software/Learning Websites

i. www.csiberkeley.com
ii. www.gtstrudl.gate
iii. www.ramint.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. B G Rajgor,** H.O.D, App. Mech. , BBIT , V V Nagar
- **Prof. K. Venkateshwarlu** , H.O.D , T F G , Adipur
- **Prof. B. G. Bhankhar**, H.O.D, App. Mech. G.P.Ahmedabad
- **Prof. J. H. Gabra**, I/C H.O.D , App. Mech. , G.P , GODHRA
- **Prof. C. H. Bhatt**, DR. S.&S.S. Ghandhy College, Surat
- **Prof. K. K. Patel**, H.O.D , G . P. Rajkot

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. M. C. Paliwal**, Associate Professor, Civil & Environmental Engineering Department.
- **Dr. V.H. Radhakrishnan,** Professor, Civil & Environmental Engineering Department.