GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: STRUCTURAL MECHANICS
(Code: 3330604**)**

Diploma Programme in which this course is offered	**Semester in which offered**
CIVIL	THIRD

1. RATIONALE

The course of Applied Mechanics considers the external effects due to action of force system as studied in Second Semester.

All Civil Engineering Structures are subjected to different loadings and behave in a specific way. In this course, analysis of determinate structures under action of transverse loading, along with, analysis of members under direct loading is stressed. Analyses of Industrial Trusses are incorporated.

This course will lay sound foundation to design Steel & Concrete Structures.

2. COMPETENCY

Understand the behaviour and Analyse Statically Determinates structures like beam, Column & Truss.

Evaluate the member material properties under direct loading

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**	
04	01	02	07	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

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **DIRECT STRESS & STRAIN**	1a. Evaluate Material Properties Under Longitudinal & Lateral Loads 1b. Analyse Composite & Compound Section 1c. Compute Strain Energy under Different Types of Loading & Calculate numerical problems	1.1 Different types of Structures and different types of Loads 1.2 Direct Stress , linear Strain , Hook's Law 1.2 –I Numerical on Problems on Direct Stress & Linear Strain 1.2 –ii Stress Strain curve of Mild Steel 1.3 – iii Modulus of Elasticity ,Yield , Breaking & Ultimate Stress and factor of Safety and problems 1.3 Lateral Strain and Poission's ratio with problems 1.4 Shear Stress , Shear Strain & Shear Modulus 1.5 Problems of Volumetric Strain 1.6 Distinguish Sudden , Gradual & Impact Load 1.6-i Define & Calculate Strain Energy & Proof Resilience for Sudden , Gradual & Impact Load
Unit – II **MOMENT OF INERTIA**	2a. Compute Moment of Inertia of Symmetric & asymmetric structural section	2.1 Moment of Inertia & its Importance 2.2 Parallel & Perpendicular Axis Theorem 2.3 Formula of Moment of Inertia of solid & Hollow sections like Rectangle , Triangle , Circle 2.4 Moment of Inertia about C.G for I section , H section , Channel Section , Angle Section , T Section and Built up Section having flange plates to I & H Section and of Double Channels back to back & toe to toe
Unit – III **S.F & B.M IN BEAM**	3a. Draw Shear Force & Bending Moment Diagram for Statically Determinate Beam	3.1 Statically Determinate Beam 3.1 – I Cantilever , Simply Supported & Over Hang Beam 3.2 Relation between Shear Force and Bending Moment 3.3 Sagging & Hogging Bending Moment and its importance 3.4 Point of Contra flexure & its importance **3.5** S.F & B.M Diagram for Cantilever , Simply Supported & Over Hang Beam subjected to Point Load and/ or U.D.L

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – IV **BENDING & SHEAR STRESSES IN BEAM**	4a. Calculate & draw Shear Stress & Apply Bending theory in Beam	4.1 Bending Theory Equation 4.1-i Bending stress , Sectional Modulus , Nutral Axis 4.1 – ii Bending theory to Statically determinate beams having rectangular or circular section 4.2 Shear Stress equation $VA\bar{Y} / (b I)$ 4.2 –i Shear Stress Distribution Diagram for Solid & Hollow Rectangular And Circular Section 4.2 – ii Shear Stress Distribution Diagram for I , H , T , Channel & Angle Section
Unit – V **ANALYSIS OF TRUSS**	5a. Analyse Statically Determinate Truss	5.1 Perfect & Imperfect Truss 5.2 Various trusses for different spans and application 5.3 Triangle , Howe , North Light & Fan truss under Panel Point Loads using Graphical & Method of Joint
Unit – VI **COLUMN & STRUT**	6a. Calculate Load carrying capacity of Column & Strut	6.1 Column & Strut 6.2 Short & Long Column 6.3 End Condition of Column and effective Length of Column & Modes of Failure in column 6.4 Radius of Gyration , Slenderness Ratio 6.5 Euler's Crippling Load 6.6 Rankin's load / Buckling Load of Column

5. 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	**DIRECT STRESS & STRAIN**	10	02	02	06	10
II	**MOMENT OF INERTIA**	06	02	00	08	10
III	**S.F & B.M IN BEAM**	14	04	00	16	20
IV	**BENDING & SHEAR STRESSES IN BEAM**	10	04	00	06	10
V	**ANALYSIS OF TRUSS**	10	04	02	06	12
VI	**COLUMN & STRUT**	06	02	02	04	08
Total		**56**	**18**	**06**	**46**	**70**

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency. Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	Tension Test on Mild Steel	04
2	I	Determine Young's Modulus of wire of Given Material	02
3	I	IZOD Impact Test on Mild Steel	02
4	I	Charpy Test	02
5	I	At Least Six Problems of Unit - I	02
6	II	Moment of Inertia of Fly Wheel	02
7	II	At least Four Problems of Moment of Inertia	02
8	IV	At Least Eight Problems of Unit IV	02
9	V	Graphical Analysis of Truss (At least THREE Trusses)	06
10	VI	Demonstrate End Conditions of Column	02
11	VI	At Least Six Problems of Unit - VI	02
		TOTAL	**28**
TUTORIAL			
1	III	AT LEAST 12 PROBLEMS OF UNIT III	08
11	V	AT LEAST 04 PROBLEMS OF UNIT V (ANALYTICAL)	06
		Total	**14**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Visit Industrial Shed ,Identify Type of Truss and its Components
2. Survey Various type of Structural Steel Sections

8. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1.	Theory of Structures	R S KHURMI	
2.	Strength of Material	S RAMAMURTHAN	
3.	Strength of Material & Mechanics of Structures	Dr. B C PUNAMIA	

B. List of Major Equipment/Materials

1. Universal Testing Machine

2. SEARL'S Apparatus to find Young's Modulus

3. Working Model of End Conditions of Column

4. IZOD Impact Test Apparatus

5. CHARPY Test Apparatus

6. FLY WHEEL

C List of Software/Learning Websites

1. *nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm*
2. *en.wikipedia.org/wiki/Shear_and_moment_**diagram***
3. www.freestudy.co.uk/mech%20prin%20h2/**stress**.pdf
4. www.engineerstudent.co.uk/**stress_and_strain**.html
5. https://www.iit.edu/arc/workshops/pdfs/**Moment_Inertia**.pdf

9. INSTRUCTIONAL STRATEGICS:

Teachers can prepare or download ppt of different topic's civil engineering application, can prepare alternative slides.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. **PROF. B G RAJGOR, H.O.D, APP. MECH. , BBIT , V V NAGAR**
2. **PROF. K VENKATESHWARLU, H.O.D, APP. MECH. , TFG POLYTECHNIC , ADIPUR**
3. **PROF. J H GABRA , I/C H.O.D , APP. MECH. , G.P , GODHARA**

Coordinator and Faculty Members from NITTTR Bhopal