**NILASAILA INSTITUTE OF SCIENCE & TECHNOLOGY**
**SERGARH-756060, BALASORE (ODISHA)**
**(Approved by AICTE& affiliated to SCTE&VT, Odisha)**

# LESSON PLAN

## SUBJECT: Th-1 (STRUCTURAL MECHANICS)

## CHAPTER WISE DISTRIBUTION OF PERIODS

| Sl.No. | Name of the chapter as per the Syllabus | No. of Periods as per the Syllabus | No. of periods actually needed |
|---|---|---|---|
| 1 | Review of Basic Concepts | 4 | 4 |
| 2 | Simple and Complex Stress, Strain | 15 | 15 |
| 3 | Stresses in Beams | 10 | 10 |
| 4 | Columns and Struts | 4 | 4 |
| 6 | Shear Force and Bending Moment | 12 | 12 |
| 7 | Slope and Deflection | 10 | 10 |
| 8 | Indeterminate Beams | 10 | 10 |
| 9 | Trusses and Frames | 10 | 10 |
| | | | |
| | Total Period: | 75 | 75 |

| **Discipline:** CIVIL ENGINEERING | **Semester:** 3rd | **Name of the Teaching Faculty:** Er. Kumar Swatiranjan |
|---|---|---|
| **Week** | **Class Day** | **Theory / Practical Topics** |
| **1st** | **1st** | 1. Review Of Basic Concepts 1.1 Basic Principle of Mechanics: Force, Moment, support conditions, Conditions of equilibrium, C.G & MI, Free body diagram |
| | **2nd** | 1. Review Of Basic Concepts 1.1 Basic Principle of Mechanics: Force, Moment, support conditions, Conditions of equilibrium, C.G & MI, Free body diagram |
| | **3rd** | 1. Review Of Basic Concepts<br>1.2 Review of CG and MI of different sections |
| | **4th** | 1. Review Of Basic Concepts<br>1.2 Review of CG and MI of different sections |
| | **5th** | 2. Simple And Complex Stress, Strain<br>2.1 Simple Stresses and Strains Introduction to stresses and strains: Mechanical properties of materials – Rigidity, Elasticity, Plasticity, Compressibility, Hardness, Toughness, Stiffness, Brittleness, Ductility, Malleability, Creep, Fatigue, Tenacity, Durability |
| **2nd** | **1st** | 2. Simple And Complex Stress, Strain<br>2.1 Simple Stresses and Strains Types of stresses -Tensile, Compressive and Shear stresses |
| | **2nd** | 2. Simple And Complex Stress, Strain<br>2.1 Simple Stresses and Strains Types of strains - Tensile, Compressive and Shear strains, Complimentary shear stress - Diagonal tensile / compressive Stresses due to shear. |
| | **3rd** | 2. Simple And Complex Stress, Strain<br>2.1 Simple Stresses and Strains Types of strains - Elongation and Contraction, Longitudinal and Lateral strains, Poisson's Ratio, Volumetric strain, computation of stress, strain, Poisson's ratio, change in dimensions and volume etc |
| | **4th** | 2. Simple And Complex Stress, Strain<br>2.1 Simple Stresses and Strains Hooke's law - Elastic Constants, Derivation of relationship between the elastic constants |

| | | |
|---|---|---|
| | **5th** | 2. Simple And Complex Stress, Strain<br>2.2 Application of simple stress and strain in engineering field<br>Behaviour of ductile and brittle materials under direct loads, Stress Strain curve of a ductile material |
| **3rd** | **1st** | 2. Simple And Complex Stress, Strain<br>2.2 Application of simple stress and strain in engineering field<br>Limit of proportionality, Elastic limit, Yield stress, Ultimate stress, Breaking stress |
| | **2nd** | 2. Simple And Complex Stress, Strain<br>2.2 Application of simple stress and strain in engineering field<br>Percentage elongation, Percentage reduction in area, Significance of percentage elongation and reduction in area of cross section |
| | **3rd** | 2. Simple And Complex Stress, Strain<br>2.2 Application of simple stress and strain in engineering field<br>Deformation of prismatic bars due to uniaxial load |
| | **4th** | 2. Simple And Complex Stress, Strain<br>2.2 Application of simple stress and strain in engineering field<br>Deformation of prismatic bars due to its self weight |
| | **5th** | 2. Simple And Complex Stress, Strain<br>2.3 Complex stress and strain Principal stresses and strains: Occurrence of normal and tangential stresses |
| **4th** | **1st** | 2. Simple And Complex Stress, Strain<br>2.3 Complex stress and strain Concept of Principal stress and Principal Plane |
| | **2nd** | 2. Simple And Complex Stress, Strain<br>2.3 Complex stress and strain Major and minor principal stresses and their orientations |
| | **3rd** | 2. Simple And Complex Stress, Strain<br>2.3 Complex stress and strain Mohr's Circle and its application to solve problems of complex stresses |
| | **4th** | 2. Simple And Complex Stress, Strain<br>2.3 Complex stress and strain Mohr's Circle and its application to solve problems of complex stresses |
| | **5th** | 3. Stresses In Beams and Shafts<br>3.1 Stresses in beams due to bending<br>Bending stress in beams – Theory of simple bending – Assumptions – Moment of resistance – Equation for Flexure– Flexural stress distribution |

| | | |
|---|---|---|
| 5th | 1st | 3. Stresses In Beams and Shafts<br>3.1 Stresses in beams due to bending<br>Curvature of beam – Position of N.A. and Centroidal Axis – Flexural rigidity – Significance of Section modulus |
| | 2nd | 3. Stresses In Beams and Shafts<br>3.2 Shear stresses in beams Shear stress distribution in beams of rectangular, circular and standard sections symmetrical about vertical axis |
| | 3rd | 3. Stresses In Beams and Shafts<br>3.2 Shear stresses in beams Shear stress distribution in beams of rectangular, circular and standard sections symmetrical about vertical axis |
| | 4th | 3. Stresses In Beams and Shafts<br>3.3 Stresses in shafts due to torsion<br>Concept of torsion, basic assumptions of pure torsion, torsion of solid and hollow circular sections, polar moment of inertia, torsional shearing stresses, angle of twist, torsional rigidity, equation of torsion |
| | 5th | 3. Stresses In Beams and Shafts<br>3.3 Stresses in shafts due to torsion<br>Concept of torsion, basic assumptions of pure torsion, torsion of solid and hollow circular sections, polar moment of inertia, torsional shearing stresses, angle of twist, torsional rigidity, equation of torsion |
| 6th | 1st | 3. Stresses In Beams and Shafts<br>3.4 Combined bending and direct stresses<br>Combination of stresses, Combined direct and bending stresses, Maximum and Minimum stresses in Sections |
| | 2nd | 3. Stresses In Beams and Shafts<br>3.4 Combined bending and direct stresses<br>Conditions for no tension, Limit of eccentricity, Middle third/fourth rule |
| | 3rd | 3. Stresses In Beams and Shafts<br>3.4 Combined bending and direct stresses Core or Kern for square, rectangular and circular sections, chimneys, dams and retaining walls |
| | 4th | 3. Stresses In Beams and Shafts<br>3.4 Combined bending and direct stresses Core or Kern for square, rectangular and circular sections, chimneys, dams and retaining walls |
| | 5th | 4. Columns and Struts<br>4.1 Columns and Struts, Definition, Short and Long columns, End conditions, Equivalent length / Effective length, Slenderness ratio |
| | 1st | 4. Columns and Struts<br>4.1 Axially loaded short and long column, Euler's theory of long columns |

| | | |
|---|---|---|
| 7th | 2nd | 4. Columns and Struts<br>4.1 Critical load for Columns with different end conditions |
| | 3rd | 4. Columns and Struts<br>4.1 Critical load for Columns with different end conditions |
| | 4th | 5. Shear Force and Bending Moment<br>5.1 Types of loads and beams Types of Loads: Concentrated (or) Point load, Uniformly Distributed load (UDL), Types of Supports: Simple support, Roller support, Hinged support, Fixed support |
| | 5th | 5. Shear Force and Bending Moment<br>5.1 Types of loads and beams Types of Reactions: Vertical reaction, Horizontal reaction, Moment reaction |
| 8th | 1st | 5. Shear Force and Bending Moment<br>5.1 Types of loads and beams Types of Beams based on support conditions: Calculation of support reactions using equations of static equilibrium |
| | 2nd | 5. Shear Force and Bending Moment<br>5.1 Types of loads and beams Types of Beams based on support conditions: Calculation of support reactions using equations of static equilibrium |
| | 3rd | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>Shear Force and Bending Moment: Signs Convention for S.F. and B.M |
| | 4th | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>S.F and B.M of general cases of determinate beams with concentrated loads and udl only |
| | 5th | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>S.F and B.M diagrams for Cantilevers beams |
| 9th | 1st | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>S.F and B.M diagrams for Simply supported beams and Over hanging beams |
| | 2nd | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>S.F and B.M diagrams for Simply supported beams and Over hanging beams |
| | 3rd | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>Position of maximum BM, Point of contra flexure |

| | | |
|---|---|---|
| | **4th** | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>Relation between intensity of load, S.F and B.M. |
| | **5th** | 5. Shear Force and Bending Moment<br>5.2 Shear force and bending moment in beams<br>Relation between intensity of load, S.F and B.M. |
| **10th** | **1st** | 6. Slope and Deflection<br>6.1 Introduction Shape and<br>nature of elastic curve (deflection curve) |
| | **2nd** | 6. Slope and Deflection<br>6.1 Introduction Shape and<br>nature of elastic curve (deflection curve) |
| | **3rd** | 6. Slope and Deflection<br>6.1 Introduction Relationship<br>between slope, deflection and curvature (No derivation) |
| | **4th** | 6. Slope and Deflection<br>6.1 Introduction Importance<br>of slope and deflection |
| | **5th** | 6. Slope and Deflection<br>6.2 Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method). |
| **11th** | **1st** | 6. Slope and Deflection<br>6.2 Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method). |
| | **2nd** | 6. Slope and Deflection<br>6.2 Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method). |
| | **3rd** | 6. Slope and Deflection<br>6.2 Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method). |
| | **4th** | 6. Slope and Deflection<br>6.2 Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method). |
| | **5th** | 6. Slope and Deflection<br>6.2 Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method). |

| | | |
|---|---|---|
| **12th** | **1st** | 7. Indeterminate Beams<br>Indeterminacy in beams, Principle of consistent deformation/compatibility |
| | **2nd** | 7. Indeterminate Beams<br>Indeterminacy in beams, Principle of consistent deformation/compatibility |
| | **3rd** | 7. Indeterminate Beams<br>Analysis of propped cantilever |
| | **4th** | 7. Indeterminate Beams<br>Analysis of propped cantilever |
| | **5th** | 7. Indeterminate Beams<br>fixed and two span continuous beams by principle of superposition |
| **13th** | **1st** | 7. Indeterminate Beams<br>fixed and two span continuous beams by principle of superposition |
| | **2nd** | 7. Indeterminate Beams<br>SF and BM diagrams (point load and udl covering full span) |
| | **3rd** | 7. Indeterminate Beams<br>SF and BM diagrams (point load and udl covering full span) |
| | **4th** | 7. Indeterminate Beams<br>SF and BM diagrams (point load and udl covering full span) |
| | **5th** | 7. Indeterminate Beams<br>SF and BM diagrams (point load and udl covering full span) |
| **14th** | **1st** | 8. Trusses<br>8.1 Introduction Types of<br>trusses, statically determinate and indeterminate trusses |
| | **2nd** | 8. Trusses<br>8.1 Introduction degree of<br>indeterminacy, stable and unstable trusses |
| | **3rd** | 8. Trusses<br>8.1 Introduction degree of<br>indeterminacy, stable and unstable trusses |
| | **4th** | 8. Trusses<br>8.1 Introduction advantages<br>of trusses |
| | **5th** | 8. Trusses<br>8.2 Analysis of trusses Analytical<br>method ( Method of joints, method of Section) |

| | | | |
|---|---|---|---|
| 15th | **1st** | 8. Trusses<br>8.2 Analysis of trusses<br>method ( Method of joints, method of Section) | Analytical |
| | **2nd** | 8. Trusses<br>8.2 Analysis of trusses<br>method ( Method of joints, method of Section) | Analytical |
| | **3rd** | 8. Trusses<br>8.2 Analysis of trusses<br>method ( Method of joints, method of Section) | Analytical |
| | **4th** | 8. Trusses<br>8.2 Analysis of trusses<br>method ( Method of joints, method of Section) | Analytical |
| | **5th** | 8. Trusses<br>8.2 Analysis of trusses<br>method ( Method of joints, method of Section) | Analytical |