BHUBANANANDA ODISHA SCHOOL OF ENGINEERING, CUTTACK

DEPARTMENT OF CIVIL ENGINEERING



LESSON PLAN

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| SUBJECT: STRUCTURAL MECHANICS (TH 1) | ACCADEMIC SESSION: 2021-22 |
| FACULTY: Dr S K NAYAK | SEMESTER: 3 RD |
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| H O D (Civil Engg.) |

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| **Discipline:**  **Civil Engineering** | **Semester: 3rd** | | **Name of the teaching faculty:**  **Dr.S.K.Nayak** |
| **Subject:**  **Structural Mechanics** | **No. of Days/ per week class allotted: 05periods per week. (Monday-1 period, Tuesday-2 period, Wednessday-1 period, Thursday-1 period)** | | **Semester From Date: 01-10-2021 To Date: 08-01-2022**  **No. of weeks: 13 weeks** |
| **Week** | **Class Day** | **No of period available** | **Theory Topics** |
| 1st | 04/10/2021 | 1 | **1.0 Review Of Basic Concepts**  **1.1** Basic Principle of Mechanics: Force, Moment, support conditions, |
| 05/10/2021 | 2 | **1.1** Conditions of equilibrium, C.G & MI, Free body diagram |
| 07/10/2021 | 1 | **1.2** Review of CG and MI of different sections |
| 2nd | 21/10/2021 | 1 | **2.0Simple And Complex Stress, Strain**  **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, |
| 3rd | 25/10/2021 | 1 | 2.1 Types of stresses -Tensile, Compressive and Shear stresses, Types of strains - Tensile, Compressive and Shear strains, |
| 26/10/2021 | 2 | 2.1 Complimentary shear stress - Diagonal tensile / compressive Stresses due to shear, Complimentary shear stress - Diagonal tensile / compressive Stresses due to shear, 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, |
| 27/10/2021 | 1 | 2.1Hooke’s law - Elastic Constants, Derivation of relationship between the elastic constants. |
| 28/10/2021 | 1 | Monthly Class Test |
| 4th | 01/11/2021 | 1 | **2.2 Application of simple stress and strain in engineering field:**  Behaviour of ductile and brittle materials under direct loads, Stress Strain curve of a ductile material |
| 02/11/2021 | 2 | 2.2 Limit of proportionality, Elastic limit, Yield stress, Ultimate stress, Breaking stress,  Percentage elongation, Percentage reduction in area, Significance of percentage elongation and reduction in area of cross section |
| 03/11/2021 | 1 | 2.2 Deformation of prismatic bars due to uniaxial load, Deformation of prismatic bars due to its self weight |
| 5th | 08/11/2021 | 1 | **2.3 Complex stress and strain**  Principal stresses and strains: Occurrence of normal and tangential stresses, Concept of Principal stress and Principal Planes, major and minor principal stresses and their orientations |
| 09/11/2021 | 2 | 2.3 Mohr’s Circle and its application to solve problems of complex stresses |
| 10/11/2021 | 1 | **3.0Stresses In Beams and Shafts**  **3.1 Stresses in beams due to bending:** Bending stress in beams – Theory of simple bending – Assumptions |
| 11/11/2021 | 1 | 3.1 Moment of resistance – Equation for Flexure– Flexural stress distribution – |
| 6th | 15/11/2021 | 1 | 3.1 Curvature of beam – Position of N.A. and Centroidal Axis – Flexural rigidity – Significance of Section modulus |
| 16/11/2021 | 2 | **3.2 Shear stresses in beams:** Shear stress distribution in beams of rectangular, circular and standard sections symmetrical about vertical axis. |
| 17/11/2021 | 1 | **3.3 Stresses in shafts due to torsion:** Concept of torsion, basic assumptions of pure torsion, |
| 18/11/2021 | 1 | 3.3 torsion of solid and hollow circular sections, polar moment of inertia  torsional shearing stresses, angle of twist, torsional rigidity, equation of torsion |
| 7TH | 22/11/2021 | 1 | **3.4 Combined bending and direct stresses:** Combination of stresses, Combined direct and bending stresses, Maximum and Minimum stresses in Sections, Conditions for no tension, |
| 23/11/2021 | 2 | 3.4 Limit of eccentricity, Middle third/fourth rule, Core or Kern for square, rectangular and circular sections, chimneys, dams and retaining walls |
| 24/11/2021 | 1 | **4.0Columns and Struts**  **4.1** Columns and Struts, Definition, Short and Long columns, End conditions, Equivalent length / Effective length, Slenderness ratio, |
| 25/11/2021 | 1 | 4.1 Axially loaded short and long column, Euler’s theory of long columns, Critical load for Columns with different end conditions |
| 8TH | 29/11/2021 | 1 | Monthly Class Test |
| 30/11/2021 | 2 | **5.0 Shear Force and Bending Moment**  **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, |
| 01/12/2021 | 1 | Internal Assessment |
| 02/12/2021 | 1 | Internal Assessment |
| 9TH | 06/12/2021 | 1 | 5.1Types of Reactions: Vertical reaction, Horizontal reaction, Moment reaction |
| 07/12/2021 | 2 | 5.1Types of Beams based on support conditions: Calculation of support reactions using equations of static equilibrium. |
| 08/12/2021 | 1 | 5.1 Shear Force and Bending Moment: Signs Convention for S.F. and B.M, S.F and B.M of general cases of determinate beams with concentrated loads and udl only |
| 09/12/2021 | 1 | 5.1 S.F and B.M diagrams for Cantilevers, Simply supported beams and Over hanging beams, Position of maximum BM |
| 10TH | 13/12/2021 | 1 | 5.1 Point of contra flexure, Relation between intensity of load, S.F and B.M. |
| 14/12/2021 | 2 | **6.0Slope and Deflection**  **6.1 Introduction:** Shape and nature of elastic curve (deflection curve); |
| 15/12/2021 | 1 | 6.1Relationship between slope deflection and curvature (No derivation), Importance of slope and deflection. |
| 16/12/2021 | 1 | **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 | 20/12/2021 | 1 | **6.2** Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay’s method). |
| 21/12/2021 | 2 | **7.0Indeterminate Beams**  **7.1** Indeterminacy in beams, Principle of consistent deformation/compatibility |
| 22/12/2021 | 1 | 7.1 Analysis of propped cantilever, fixed and two span continuous beams by principle of superposition |
| 23/12/2021 | 1 | 7.1 SF and BM diagrams (point load and udl covering full span) |
| 12TH | 27/12/2021 | 1 | **8.0Trusses**  **8.1 Introduction:** Types of trusses, statically determinate and indeterminate trusses |
| 28/12/2021 | 2 | **8.2 Analysis of trusses:** Analytical method ( Method of joints, method of Section) |
| 29/12/2021 | 1 | 8.2 degree of indeterminacy, stable and unstable trusses, advantages of trusses. |
| 30/12/2021 | 1 | Monthly Class Test |
| 13TH | 03/01/2022 | 1 | Revision |
| 04/01/2022 | 2 | Revision |
| 05/01/2022 | 1 | Revision |
| 06/01/2022 | 1 | Previous Year Questions Discussion |