



**RAAJDAHNI ENGINEERING COLLEGE, BHUBANESWAR**  
**CIVIL ENGINEERING DEPARTMENT**

**LESSON PLAN**  
**2023-2024**

**SESSION** :: Sep-2023-Jan-2024  
**Course Type** :: Theory  
**Semester/Branch** :: 3<sup>rd</sup> Semester, Civil Engineering  
**Subject (with code)** :: Structural Mechanics (Th-1)  
**Contact hours/week** :: 4 hours  
**Name of Faculty** :: Prof. Md Aras Ansari

| Sl. No. | Topics to be covered   | OTHER SOURCE(IM)  |
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| 1       | Basic Principle of Mechanics: Force, Moment, support conditions,   | <a href="https://youtu.be/GkFgysZC4Vc?si=4uY4Oezz7F5zyk76">https://youtu.be/GkFgysZC4Vc?si=4uY4Oezz7F5zyk76</a> |
| 2       | Conditions of equilibrium, C.G & MI, Free body diagram,  | <a href="https://youtu.be/PtEOFJGM2_I?si=rFes5fTzAWZo_G6">https://youtu.be/PtEOFJGM2_I?si=rFes5fTzAWZo_G6</a>   |
| 3       | Review of CG and MI of different sections  | <a href="https://youtu.be/BOlzWHEUCUI?si=VfPd4kSMWkC5Uo-e">https://youtu.be/BOlzWHEUCUI?si=VfPd4kSMWkC5Uo-e</a> |
| 4       | Introduction to stresses and strains: Mechanical properties of materials Rigidity, Elasticity, Plasticity, Compressibility, Hardness,              | <a href="https://youtu.be/9qcqfp5d6aA?si=p3kW6wx5wMvjMoGy">https://youtu.be/9qcqfp5d6aA?si=p3kW6wx5wMvjMoGy</a> |
| 5       | Toughness, Stiffness, Brittleness, Ductility, Malleability, Creep, Fatigue, Tenacity, Durability,  | <a href="https://youtu.be/9qcqfp5d6aA?si=p3kW6wx5wMvjMoGy">https://youtu.be/9qcqfp5d6aA?si=p3kW6wx5wMvjMoGy</a> |
| 6       | Types of stresses -Tensile, Compressive and Shear stresses, Types of strains - Tensile, Compressive and Shear strains, Complimentary shear Stress, | <a href="https://youtu.be/USCLWUuprs4?si=PIEB4aKz2UBwwSZ-">https://youtu.be/USCLWUuprs4?si=PIEB4aKz2UBwwSZ-</a> |
| 7       | Diagonal tensile / compressive Stresses due to shear,  | <a href="https://www.youtube.com/watch?v=2EP-EuI4aYw">https://www.youtube.com/watch?v=2EP-EuI4aYw</a>           |
| 8       | Elongation and Contraction, Longitudinal and Lateral strains, Poisson's Ratio, Volumetric strain   | <a href="https://youtu.be/I4UkkQEUUMI?si=AITYbLj_MRBRObu5">https://youtu.be/I4UkkQEUUMI?si=AITYbLj_MRBRObu5</a> |
| 9       | Computation of stress, Strain, Poisson's ratio, change in dimensions and volume etc,   | <a href="https://youtu.be/I4UkkQEUUMI?si=AITYbLj_MRBRObu5">https://youtu.be/I4UkkQEUUMI?si=AITYbLj_MRBRObu5</a> |

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| 10 | Hooke's law - Elastic Constants, Derivation of relationship between the elastic constants.  | <a href="https://youtu.be/LdzJNSvLnGQ?si=GlfsZT1UzBzc1VX3">https://youtu.be/LdzJNSvLnGQ?si=GlfsZT1UzBzc1VX3</a>   |
| 11 | Behaviour of ductile and brittle materials under direct loads,  | <a href="https://youtu.be/wLrfNkRTYjc?si=MrGGHsg4uQLnfYJB">https://youtu.be/wLrfNkRTYjc?si=MrGGHsg4uQLnfYJB</a>   |
| 12 | Stress Strain curve of a ductile material, Limit of proportionality, Elastic limit, Yield stress, Ultimate stress, Breaking stress, | <a href="https://youtu.be/7OXQNv73qr4?si=MdDnnTRbmzjYL7CY">https://youtu.be/7OXQNv73qr4?si=MdDnnTRbmzjYL7CY</a>   |
| 13 | Percentage elongation, Percentage reduction in area, Significance of percentage elongation and reduction in area of cross section,  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                         |
| 14 | Deformation of prismatic bars due to uniaxial load, Deformation of prismatic bars due to its self-weight                            | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                         |
| 15 | Occurrence of normal and tangential stresses, Concept of Principal stress, and Principal Planes,                                    | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                         |
| 16 | Major and minor principal stresses and their orientations.  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                         |
| 17 | Mohr's Circle and its application to solve problems of complex stresses,  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                         |
| 18 | Bending stress in beams Theory of simple bending, Assumptions   | <a href="https://youtu.be/t8YnpxtJPTE?si=ikJAUQU1hG8mJdLG">https://youtu.be/t8YnpxtJPTE?si=ikJAUQU1hG8mJdLG</a>   |
| 19 | Moment of resistance – Equation for Flexure– Flexural stress distribution   | <a href="https://youtu.be/t8YnpxtJPTE?si=ikJAUQU1hG8mJdLG">https://youtu.be/t8YnpxtJPTE?si=ikJAUQU1hG8mJdLG</a>   |
| 20 | Curvature of beam – Position of N.A. and Centroidal Axis – Flexural rigidity – Significance of Section modulus                      | <a href="https://youtu.be/AvCkrU3KaZw?si=hxJjux7Ofk3bS0Sd">https://youtu.be/AvCkrU3KaZw?si=hxJjux7Ofk3bS0Sd</a>   |
| 21 | Shear stress distribution in beams of rectangular, circular, and standard sections symmetrical about vertical axis                  | <a href="https://youtu.be/AvCkrU3KaZw?si=hxJjux7Ofk3bS0Sd">https://youtu.be/AvCkrU3KaZw?si=hxJjux7Ofk3bS0Sd</a>   |
| 22 | Concept of torsion, basic assumptions of pure torsion,  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                         |
| 23 | Torsion of solid and hollow circular sections & Problem Practice  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                         |
| 24 | Polar moment of inertia, torsional shearing stresses, angle of twist,   | <a href="https://youtu.be/HTW0PxHw_00?si=k0Kt6xccc8_S0LKfX">https://youtu.be/HTW0PxHw_00?si=k0Kt6xccc8_S0LKfX</a> |

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| 25 | Torsional rigidity, equation of torsion.  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 26 | Combination of stresses,<br>Combined direct and bending stresses.   | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 27 | Maximum and Minimum stresses in Sections, Conditions for no tension & Problem Practice  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 28 | Limit of eccentricity, Middle third/fourth rule,  | <a href="https://youtu.be/tQZQDiD79zc?si=VUQui07rv5nHT_of">https://youtu.be/tQZQDiD79zc?si=VUQui07rv5nHT_of</a> |
| 29 | Core or Kern for square, rectangular, and circular sections, chimneys, dams and retaining walls   | <a href="https://youtu.be/PdYJTa8o1LU?si=MGyq45wTuLIyhplo">https://youtu.be/PdYJTa8o1LU?si=MGyq45wTuLIyhplo</a> |
| 30 | Columns and Struts, Definition, Short and Long columns, End conditions  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 31 | Equivalent length / Effective length, Slenderness ratio, axially loaded short and long column   | <a href="https://youtu.be/tQZQDiD79zc?si=VUQui07rv5nHT_of">https://youtu.be/tQZQDiD79zc?si=VUQui07rv5nHT_of</a> |
| 32 | Euler's theory of long columns, Critical load for Columns with different end conditions,  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 33 | Types of Loads: Concentrated (or) Point load, Uniformly Distributed load (UDL), Types of Supports: Simple support, Roller support, Hinged support, Fixed support, | <a href="https://youtu.be/2uBmWVJosZs?si=JkaG16q2mpyCxqBi">https://youtu.be/2uBmWVJosZs?si=JkaG16q2mpyCxqBi</a> |
| 34 | Types of Reactions: Vertical reaction, Horizontal reaction, Moment reaction,  | <a href="https://youtu.be/2uBmWVJosZs?si=JkaG16q2mpyCxqBi">https://youtu.be/2uBmWVJosZs?si=JkaG16q2mpyCxqBi</a> |
| 35 | Types of Beams based on support conditions<br>Calculation of support reactions using equations of static equilibrium  | <a href="https://youtu.be/bA9zhZxw6dI?si=n9X-KjptGcL_vUo1">https://youtu.be/bA9zhZxw6dI?si=n9X-KjptGcL_vUo1</a> |
| 36 | Shear Force and Bending Moment: Signs Convention for S.F. and B.M, S.F and B.M of 43 general cases of determinate beams with concentrated loads and udl only      | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 37 | S.F and B.M diagrams for Cantilevers  | <a href="https://youtu.be/g0LdpGjyay0?si=zAkg9-C9AmVcFt0z">https://youtu.be/g0LdpGjyay0?si=zAkg9-C9AmVcFt0z</a> |
| 38 | S.F and B.M diagrams for Simply supported beams and over hanging beams)   | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |

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| 39 | Position of maximum BM, Point of contra flexure)   | <a href="https://youtu.be/g0LdpGjyay0?si=zAkg9-C9AmVcFt0z">https://youtu.be/g0LdpGjyay0?si=zAkg9-C9AmVcFt0z</a> |
| 40 | Relation between intensity of load, S.F and B.M.   | <a href="https://youtu.be/g0LdpGjyay0?si=zAkg9-C9AmVcFt0z">https://youtu.be/g0LdpGjyay0?si=zAkg9-C9AmVcFt0z</a> |
| 41 | Shape and nature of elastic curve (deflection curve); Relationship between slope, deflection, and curvature (No derivation), | <a href="https://youtu.be/K8yvy3cB9aM?si=8v8b355qR8GFPizi">https://youtu.be/K8yvy3cB9aM?si=8v8b355qR8GFPizi</a> |
| 42 | Importance of slope and deflection   | <a href="https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7">https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7</a> |
| 43 | Slope and deflection of cantilever and simply supported beams under concentrated load by Double Integration method           | <a href="https://youtu.be/K8yvy3cB9aM?si=8v8b355qR8GFPizi">https://youtu.be/K8yvy3cB9aM?si=8v8b355qR8GFPizi</a> |
| 44 | Slope and deflection of cantilever and simply supported beams under uniformly distributed load by Double Integration method, | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 45 | Slope and deflection of simply supported beams under concentrated and uniformly distributed load by Macaulay's method.       | <a href="https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7">https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7</a> |
| 46 | Indeterminacy in beams, Principle of consistent deformation/compatibility  | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |
| 47 | Analysis of propped cantilever,  | <a href="https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7">https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7</a> |
| 48 | Fixed and two span continuous beams by principle of superposition  | <a href="https://youtu.be/3Jer0roq1yg?si=AG6C_CvobbIA-CZp">https://youtu.be/3Jer0roq1yg?si=AG6C_CvobbIA-CZp</a> |
| 49 | Fixed and two span continuous beams by principle of superposition  | <a href="https://youtu.be/3Jer0roq1yg?si=AG6C_CvobbIA-CZp">https://youtu.be/3Jer0roq1yg?si=AG6C_CvobbIA-CZp</a> |
| 50 | SF and BM diagrams (point load)  | <a href="https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7">https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7</a> |
| 51 | SF and BM diagrams udl covering full span  | <a href="https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7">https://youtu.be/K8yvy3cB9aM?si=GWcAdmCu4iGrkVy7</a> |
| 52 | Types of trusses   | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>                       |

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| 53 | statically determinate and indeterminate trusses | <a href="https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB">https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB</a>                     |
| 54 | Degree of indeterminacy, stable stresses         | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>   |
| 55 | Degree of indeterminacy, unstable trusses        | <a href="https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB">https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB</a>                     |
| 56 | Advantages of trusses.                           | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>   |
| 57 | Analytical method (Method of joints)             | <a href="https://nptel.ac.in/courses/105104160">https://nptel.ac.in/courses/105104160</a>   |
| 58 | Analytical method (Method of joints.             | <a href="https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB">https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB</a>                     |
| 59 | Analytical method (Method, of Section            | <a href="https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB">https://youtu.be/3-4wNORPjXY?si=1CquD4Ck1vpcLvGB</a>                     |
| 60 | Previous years Q&A Discussion                    | <a href="https://youtube.com/shorts/9LDWvJR_i-g?si=fJX9X-ssUMKoZhhi">https://youtube.com/shorts/9LDWvJR_i-g?si=fJX9X-ssUMKoZhhi</a> |

