

IIPM SCHOOL OF ENGINEERING AND TECHNOLOGY

*LESSON PLAN: 2023-24*

# Sub : Strength of material (Th-2)

**Faculty name : B. Mohanta**

# Branch : Mechanical Engineering

**Semester : 3rd**

# Duration : 60 hours

**SYLLABUS: -**

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| **UNIT - 1** | **Simple stress& strain**  1.1 Types of load, stresses & strains,(Axial and tangential) Hooke’s law, Young’s modulus, bulk modulus, modulus of rigidity, Poisson’s ratio, derive the relation between three elastic constants,  1.2 Principle of super position, stresses in composite section  1.3 Temperature stress, determine the temperature stress in composite bar (single core)  1.4 Strain energy and resilience, Stress due to gradually applied, suddenly applied and impact load  1.5 Simple problems on above. |
| **UNIT- 2** | **Thin cylinder and spherical shell under internal pressure**  2.1 Definition of hoop and longitudinal stress, strain  2.2 Derivation of hoop stress, longitudinal stress, hoop strain, longitudinal strain and volumetric strain  2.3 Computation of the change in length, diameter and volume  2.4 Simple problems on above |
| **UNIT– 3** | **Two-dimensional stress systems**  3.1 Determination of normal stress, shear stress and resultant stress on oblique plane  3.2 Location of principal plane and computation of principal stress  3.3 Location of principal plane and computation of principal stress and  Maximum shear stress using Mohr’s circle |
| **UNIT - 4** | **Bending moment& shear force**  4.1 Types of beam and load  4.2 Concepts of Shear force and bending moment  4.3 Shear Force and Bending moment diagram and its salient features illustration in cantilever beam, simply supported beam and over hanging beam under point load and uniformly distributed load |
| **UNIT - 5** | **Theory of simple bending**  5.1 Assumptions in the theory of bending,  5.2 Bending equation, Moment of resistance, Section modulus& neutral axis.  5.3 Solve simple problems. |
| **UNIT - 6** | **Combined direct & bending stresses**  6.1 Define column  6.2 Axial load, Eccentric load on column,  6.3 Direct stresses, Bending stresses, Maximum& Minimum stresses. Numerical problems on above.  6.4 Buckling load computation using Euler’s formula (no derivation) in  Columns with various end conditions |
| **UNIT - 7** | **Torsion**  7.0 Assumption of pure torsion  7.1 The torsion equation for solid and hollow circular shaft  7.2 Comparison between solid and hollow shaft subjected to pure torsion |

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| **SI NO** | **AUTHOR** | **TITLE OF THE BOOK** | **PUBLISHER** |
| **1** | S RAMAMRUTHAM | Strength Of Materials | Dhanpat Rai |
| **2** | R K RAJPUT | Strength Of Materials | S.Chand |
| **3** | R.S KHURMI | Strength of Materials | S.Chand |
| **4** | G H RYDER | Strength of Materials | Mc millon and co. lmtd |
| **5** | S TIMOSHENKO AND D H YOUNG | Strength of Materials | TMH |

**Objective :** This subject useful for detailed study of force and their effects. This knowledge is very essential for an engineer, to enable him, in designing all type of structure and machine.

To provide the basic concepts and principles of strength f material And to give an ability to analyze a given problem in a simple manner.

To give ability to calculate stresses and deformation of objects under external forces. To give an ability to apply the knowledge of strength of materials engineering application and design problems.

# Learning Outcome:

To understand the basic of material properties, stress, and strain.

To apply knowledge of mathematics, science, for engineering applications. Ability to identify, formulate, and solve engineering & real-life problems.

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| **Sl.No** | **Chapter** | **Proposed Week for**  **Teaching** | **Lecture No.** | **Sub. Topic** | **Important Teaching Points** | **Content Source** |
| 1 | I | 1 | 1 | Simple Stress & Strain | Basic fundamental classes | R.S. KHURMI PG NO 12,13,14 |
| 2 | 2 | Simple Stress & Strain | Explain stress, strain curve.  Elasticity Plasticity Stress strain | R.S. KHURMI PG NO  18,19 |
| 3 | 3 | Simple Stress & Strain | Hooks law,  young’s modulus  Simple problems on above. | R.S. KHURMI  R.S. KHURMI PG NO |

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| 4 | 4 | Simple Stress & Strain | Bulk modulus modulus of rigidity Poisson’s ratio derive the relation between three elastics  Simple problems on  above. | R.S. KHURMI PG NO 20,21,22,23,24 EXERCISE3.1 |
| 5 | I | 2 | 1 | Simple Stress & Strain | Principle of super position, stresses in composite section  Simple problems on above. | R.S. KHURMI PG NO 25,26,27 EXERCISE3.2 |
| 6 | 2 | Simple Stress & Strain | Temperature stress. Determine the  temperature stress in composite bar | R.S. KHURMI PG NO  75,76 |
| 7 | 3 | Simple Stress & Strain | Temperature stress. temperature stress in composite bar  Simple problems on above | R.S. KHURMI PG NO  79 |
| 8 | 4 | Simple Stress & Strain | Strain energy and resilience, Stress due to gradually applied. | R.S. KHURMI PG NO  84 |
| 9 | I  & II | 3 | 1 | Simple Stress & Strain | Strain energy and resilience, Stress due to suddenly applied and impact load | R.S. KHURMI 85 |
| 10 | 2 | Simple Stress & Strain | Simple problems on above. | R.S. KHURMI  90 |
| 11 | 3 | Thin cylinder and spherical shell under internal pressure | Introduction Definition of hoop stress  Thin cylinder Hoop stress or  circumferential stress derivation | R.S. KHURMI PG NO 497,498, |
| 12 | 4 | Thin cylinder and spherical shell under  internal pressure | Longitudinal stress 2 Derivation  Thin spherical shell  under internal pressure derivation | R.S. KHURMI 499, |
| 13 | II | 4 | 1 | Thin cylinder and spherical shell under  internal pressure | Volumetric strain Longitudinal Strain Derivation | R.S. KHURMI 502 |
|  | 2 | Thin cylinder and spherical shell under  internal pressure | Hoop Strain  Derivation | R.S. KHURMI NOTES |
| 14 | 3 | Thin cylinder  and spherical shell under | Longitudinal Strain  Derivation | R.S. KHURMI NOTES |

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|  |  |  |  | internal pressure |  |  |
| 15 | 4 | Thin cylinder and spherical shell under  internal pressure | Volumetric Strain on capacity Derivation | R.S. KHURMI NOTES |
| 16 | II  & III | 5 | 1 | Thin cylinder and spherical shell under  internal pressure | Numerical problems on above | R.S. KHURMI 500, 501 |
| 17 | 2 | Thin cylinder and spherical shell under  internal pressure | Solved Previous year question | R.S. KHURMI 502,503 EXERCISE23.2 |
| 18 | 3 | Two- dimensional stress systems | Determination of normal stress, shear stress and resultant  stress on oblique plane. | R.S. KHURMI |
| 19 | 4 | Two- dimensional stress systems | Stress on oblique plane  Define Pure Shear | R.S. KHURMI |
| 20 | III | 6 | 1 | Two- dimensional  stress systems | Derivation Pure Normal stresses on  give planes | R.S. KHURMI |
| 21 | 2 | Two- dimensional  stress systems | Derivation two- dimensional Stress  system. | R.S. KHURMI |
| 22 | 3 | Two- dimensional stress systems | Derivation Principal Planes | R.S. KHURMI |
| 23 | 4 | Two-  dimensional stress systems | Derivation Principal Stresses | R.S. KHURMI |
| 24 | III III |  | 1 | Two- dimensional stress systems | Derivation Shorter method for principal stresses | R.S. KHURMI |
| 25 | 2 | Two-  dimensional stress systems | Derivation Maximum shear stress | R.S. KHURMI |
| 26 | 3 | Two-  dimensional stress systems | Numerical problems on above | R.S. KHURMI |
| 27 | 4 | Two-  dimensional stress systems | Numerical problems on above | R.S. KHURMI |
| 28 | III |  | 1 | Bending moment& shear force | Explain Types of beams  Explain Types of loads | R.S. KHURMI PG NO 258,259,260 |
| 29 | 2 | Bending moment& shear force | Explain Cantilever beam with point  load Problems on above. | R.S. KHURMI 261 |

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| 30 | & IV | 7 | 3 | Bending moment& shear force | Explain Cantilever beam with UDL Problems on above. | R.S. KHURMI 262,263 |
| 31 | 4 | Bending moment& shear force | Cantilever beam problem with point load and UDL | R.S. KHURMI PG NO  264  EXERCISE 13.1 |
| 32 | IV | 8 | 1 | Bending moment& shear force | Explain simply supported beam with point load  Problems on above. | R.S. KHURMI PG NO  PG NO 268,269 |
| 33 | 2 | Bending moment& shear force | Explain simply supported beam with UDL  Problems on above. | R.S. KHURMI PG NO 270,271,272, |
| 34 | 3 | Bending moment& shear force | simply supported beam problem with point load and UDL | R.S. KHURMI PG NO 273,274,275  EXERCISE13.2 |
| 35 | 4 | Bending moment& shear force | Explain over hanging beam with point load Problems on above | R.S. KHURMI  PG NO 282,283,284,285 |
| 36 | IV  & V | 9 | 1 | Bending moment& shear force | Explain over hanging beam with UDL Problems on above | R.S. KHURMI  PG NO 282,283,284,285 |
| 37 | 2 | Bending moment& shear force | over hanging beam problem  With UDL & point load. | R.S. KHURMI PG NO 288,289,290 |
| 38 | 3 | Theory of simple bending | Introduction Assumptions in  ‘Theory of bending’ | R.S. KHURMI PG NO 313,314 |
| 39 | 4 | Theory of  simple bending | Derived Bending equation. | R.S. KHURMI PG NO  314,315,3165 |
| 40 | V | 10 | 1 | Theory of simple bending | Explain Position of Neutral Axis Moment resistance  Explain Section Modules | R.S. KHURMI. PG NO  317,318,319 |
| 41 | 2 | Theory of simple bending | Rectangular section Problem on moment  resistance & neutral axis | R.S. KHURMI PG NO 319,320,321,322 |
| 42 | 3 | Theory of simple bending | Hollow rectangular section  Problem on moment resistance & neutral axis | R.S. KHURMI PG NO 322,324,325 |

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| 43 |  |  | 4 | Theory of simple bending | Circular section Problem on moment  resistance & neutral axis | R.S. KHURMI PG NO 322,324,325 |
| 44 | V | 11 | 1 | Theory of simple bending | Hollow circular section  Problem on moment resistance & neutral axis | R.S. KHURMI PG NO 322,324,325 |
| 45 | 2 | Theory of  simple bending | problems on above. | R.S. KHURMI PG NO 326,327 |
| 46 | 3 | Theory of simple bending | problems on above. | R.S. KHURMI 328,329 |
| 47 | 4 | Theory of simple bending | problems on above. | R.S. KHURMI PG NO  330  EXERCISE 14.2 |
| 48 | VI | 12 | 1 | Combined direct & bending stresses | Explain about column  Axial load, Eccentric load on column, | R.S. KHURMI PG NO 374,375 |
| 49 | 2 | Combined direct & bending stresses | Explain Direct stresses  Bending stresses. Maximum& Minimum stresses on column | R.S. KHURMI PG NO 375,376 |
| 50 | 3 | Combined direct & bending  stresses | Numerical problems on above | R.S. KHURMI PG NO  377 |
| 51 | 4 | Combined direct &  bending stresses | Numerical problems on above | R.S. KHURMI 378 |
| 52 | VI | 13 | 1 | Combined direct & bending  stresses | Buckling load computation using Euler’s formulas | R.S. KHURMI PG NO  380 |
| 53 | 2 | Combined direct &  bending stresses | Columns with various end conditions Numerical problems on above | R.S. KHURMI 381,382,383,387,388 |
| 54 | 3 | Torsion | Assumption of pure torsion  Derivation | R.S. KHURMI PG NO  455,456 |
| 55 | 4 | Torsion | The torsion equation for solid | R.S. KHURMI PG NO |

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| 56 | VI | 14 | 1 | Torsion | Numerical problems on above | R.S. KHURMI  457 |
| 57 | 2 | Torsion | The torsion equation for  hollow circular shaft | R.S. KHURMI PG NO  458, |
| 58 | 3 | Torsion | Numerical problems on above | R.S. KHURMI 458 |
| 59 | 4 | Torsion | Comparison between solid and hollow shaft | R.S. KHURMI PGNO 460,461  EXERCISE 21.1 |

# Text book suggested: R.S. KHURMI & PERSONAL NOTES

Signature of

Faculty Member HOD Principal/ Director