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| **LESSON PLAN(2022-23)** |
| **Academic Year** | **: 2022-2023** | **Semester** | **: II** |  |
| **Name of the Program** | **: B.Tech(R20-Regulation)** | **Year** | **: II** |  |
| **Course/Subject** | **: STRENGTH OF MATERIALS-II** | **Course Code** | **:** |  |
| **Name of the Faculty** | **: Ms.Y.Priyanka** | **Branch** | **: CIVIL** |  |
| **Designation** | **: Assistant Professor** |  |  |  |
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| ***II Year – II Semester*** |  | ***L*** | ***T*** | ***P*** | ***C*** |
| ***STRENGTH OF MATERIALS-II*** | ***3*** | ***0*** | ***0*** | ***3*** |

 |
| **UNIT****NO** | **LEC****NO** | **CONTENTS** | **DATE OF****LECTURE** | **TEXT/****REFERENCE** | **NATURE OF****LECTURE** |
| UNIT- I Principal Stresses and Strains And Theories of Failures: Introduction-Stresses on an inclined section of a bar under axial loading compound stresses-Normal and tangential stresses on an inclined plane for biaxial stresses-Two perpendicular normal stresses accompanied by a state of simple shear-Mohr’s circle of stresses. Principal stresses and strains-Analytical and graphical solutions. Theories of Failures: Introduction Various Theories of failures like Maximum Principal stress theory-Maximum Principal strain theory-Maximum shear stress theory-Maximum strain energy theory-Maximum shear strain energy theory. |
| ***UNIT-1*** | 1 | Introduction-Stresses on an inclined section of a bar under axial loading compound stresses |  | **T1**  | **CHALK AND BLACK BOARD** |
| 2 | Normal and tangential stresses on an inclined plane for biaxial stresses |  | **T1**  |
| 3 | Two perpendicular normal stresses accompanied by a state of simple shear |  | **T1**  |
| 4 | Mohr’s circle of stresses |  | **T1**  |
| 5 | Principal stresses and strains |  | **T1**  |
| 6 | Problems |  | **T1**  |
| 7 | Problems |  | **T1** |
| 8 | Problems |  | **T1**  |
| 9 | Analytical and graphical solutions |  | **T1** |
| 10  | Introduction Various Theories of failures like Maximum Principal stress theory |  | **T1** |
| 11 | Maximum Principal strain theory |  | **T1** |
| 12 | Maximum shear stress theory |  | **T1** |
| 13 | Maximum strain energy theory |  | **T1** |
| 14 | Maximum shear strain energy theory |  | **T1** |
| 15 | Problems |  | **T1** |
| 16 | Problems |  | **T1** |
| 17 | Problems |  | **T1** |
| 18 | Problems |  | **T1** |
| 19 | Problems |  | **T1** |
| 20 | Problems |  | **T1** |
| 21 | Revision |  |  | **PPT** |
| 22 | Revision |  |  |
| UNIT-II **Torsion of Circular Shafts and Springs:** Theory of pure torsion-Derivation of Torsion equations: T/J = q/r = N /L-Assumptions made in the theory of pure torsion-Torsional moment of resistance-Polar section modulus-Power transmitted by shafts-Combined bending and torsion and end thrust-Design of shafts according to theories of failure. **Springs:** Introduction-Types of springs-deflection of close and open coiled helical springs under axial pull and axial couple-springs in series and parallel. |
| ***UNIT-2*** | 1 | Theory of pure torsion-Derivation of Torsion equations: T/J = q/r = N /L |  | **T1 / T2** | **CHALK AND BLACK BOARD** |
| 2 | Assumptions made in the theory of pure torsion |  | **T1 / T2** |
| 3 | Torsional moment of resistance |  | **T1 / T2** |
| 4 | Polar section modulus |  | **T1 / T2** |
| 5 | Power transmitted by shafts |  | **T1 / T2** |
| 6 | Combined bending and torsion and end thrust |  | **T1 / T2** |
| 7 | Design of shafts according to theories of failure |  | **T1 / T2** |
| 8 | Introduction-Types of springs-deflection of close and open coiled helical springs under axial pull |  | **T1 / T2** |
| 9 | axial couple-springs in series and parallel |  | **T1 / T2** |
| 10 | Problems |  | **T1 / T2** | **PPT** |
| 11 | Problems |  | **T1 / T2** |
| 12 | Problems |  | **T1 / T2** |
| 13 | Problems |  | **T1 / T2** |
| 14 | Problems |  | **T1 / T2** |
| 15 | Problems |  | **T1 / T2** |
| 16 | Problems |  | **T1 / T2** |
| 17 | Problems |  | **T1 / T2** |
| 18 | Revision |  |  |
| 19 | Revision |  |
| UNIT-III Columns and Struts: Introduction-Types of columns-Short, medium and long columns – Axially loaded compression members – Crushing load – Euler’s theorem for long columns- assumptions- derivation of Euler’s critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler’s critical stress – Limitations of Euler’s theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula –Prof. Perry’s formula. |
| ***UNIT-3*** | 1 | Columns and Struts: Introduction-Types of columns-Short, medium and long columns |  | **T1 / T2** | **CHALK AND BLACK BOARD** |
| 2 | Axially loaded compression members |  | **T1 / T2** |
| 3 | Crushing load – Euler’s theorem for long columns- assumptions |  | **T1 / T2** |
| 4 | derivation of Euler’s critical load formulae for various end conditions |  | **T1 / T2** |
| 5 | Equivalent length of a column |  | **T1 / T2** |
| 6 | Problems |  | **T1 / T2** |
|  | 7 |  |  | **T1 / T2** |  |
|  | 8 | slenderness ratio – Euler’s critical stress |  | **T1 / T2** |  |
|  | 9 | Limitations of Euler’s theory – Rankine |  | **T1 / T2** |  |
|  | 10 | Problems |  | **T1 / T2** |  |
|  | 11 | Problems |  |  |  |
|  | 12 | Gordon formula – Long columns subjected to eccentric loading |  |  |  |
|  | 13 | Problems |  |  |  |
|  | 14 | Problems |  |  |  |
|  | 15 | Secant formula – Empirical formulae |  | **T1 / T2** |  |
|  | 16 | Problems |  |  |  |
|  | 17 | Problems |  |  |  |
|  | 18 | Prof. Perry’s formula |  | **T1 / T2** |  |
|  | 19 | Problems |  |  |  |
|  | 20 | Problems |  | **T1 / T2** |  |

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|   |  21 | Revision |  |  | **PPT** |
| 22 | Revision |  |
| UNIT-IV **Direct and Bending Stresses:** Stresses under the combined action of direct loading and B.M. Core of a section  determination of stresses in the case of chimneys, retaining walls and dams-conditions for stability-stresses due to direct loading and B.M. about both axis. |
| ***UNIT-4*** | 1 | Stresses under the combined action of direct loading and B.M |  | **T1 / T2** |  |
| 2 | Problems |  | **T1 / T2** |  |
| 3 | Problems |  | **T1 / T2** | **CHALK AND BLACK BOARD** |
| 4 | Problems |  | **T1 / T2** |
| 5 | Core of a section  determination of stresses in the case of chimneys |  | **T1 / T2** |
| 6 | Problems |  | **T1 / T2** |
| 7 | Problems |  | **T1 / T2** |  |
| 8 | retaining walls and dams |  | **T1 / T2** |  |
| 9 | Problems |  | **T1 / T2** |  |
| 10 | Problems |  | **T1 / T2** |  |
| 11 | conditions for stability-stresses due to direct loading and B.M. about both axis |  | **T1 / T2** |  |
| 12 | Problems |  | **T1 / T2** |  |
| 13 | Problems |  | **T1 / T2** |  |
| 14 | Revision |  |  |  |
| 15 | Revision |  |  |
| UNIT-V Unsymmetrical Bending and Shear Centre-Un-symmetrical Bending: Introduction-Centroidal principal axes of section-Graphical method for locating principal axes-Moments of inertia referred to any set of rectangular axes-Stresses in beams subjected to unsymmetrical bending-Principal axes-Resolution of bending moment into two rectangular axes through the centroid-Location of neutral axis Deflection of beams under unsymmetrical bending. Shear Centre: Introduction Shear center for symmetrical and unsymmetrical sections (channel, I, T and L sections). |
| ***UNIT-5*** | 1 | Introduction-Centroidal principal axes of section |  | **T1 / T2** |  |
| 2 | Problems |  | **T1 / T2** |  |
| 3 | Graphical method for locating principal axes |  | **T1 / T2** | **CHALK AND BLACK BOARD** |
| 4 | Problems |  | **T1 / T2** |
| 5 | Problems |  | **T1 / T2** |
| 6 | Moments of inertia referred to any set of rectangular axes |  |  |
| 7 | Problems |  |  |
| 8 | Problems |  |  |
| 9 | Stresses in beams subjected to unsymmetrical bending-Principal axes |  |  |
| 10 | Problems |  |  |
| 11 | Problems |  |  |
| 12 | Resolution of bending moment into two rectangular axes through the centroid |  |  |
| 13 | Problems |  |  |
| 14 | Problems |  |  |
| 15 | Location of neutral axis Deflection of beams under unsymmetrical bending |  |  |
| 16 | Problems |  |  |
| 17 | Problems |  |  |
| 18 | Shear Centre: Introduction Shear center for symmetrical and unsymmetrical sections (channel, I, T and L sections) |  |  |
| 19 | Problems |  |  |
| 20 | Problems |  |  |
| 21 | Problems |  |  |
| 22 | Problems |  | **T1 / T2** |
| 23 | Revision |  |  | **PPT** |
| 24 | Revision |  |  |

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| CO1 | The student will be able to understand the basic concepts of Principal stresses developed in a member when it is subjected to stresses along different axes and design the sections. | APPLY,ANALYZE,EVALUATE | K3,K4,K5 |
| CO2 | The student can assess stresses in different engineering applications like shafts, springs, columns and struts subjected to different loading conditions | APPLY,ANALYZE,EVALUATE | K3,K4,K5 |
| CO3 |  Will be able to Understand Introduce the concept of unsymmetrical bending in beams Location of neutral axis Deflection of beams under unsymmetrical bending. | APPLY,ANALYZE,EVALUATE | K3,K4,K5 |
| CO4 |  Will be able to classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions and to calculate combined effect of direct and bending stresses on different engineering structures. | APPLY,ANALYZE,EVALUATE | K3,K4,K5 |
| CO5 | Will be able to give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs and design the cross section when subjected to loading using different theories of failures. | APPLY,ANALYZE,EVALUATE | K3,K4,K5 |

CO-PO Mapping: **(**1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]]; ‘-‘: No Correlation**)**

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|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1-K4 | **2** | **3** | **1** | **2** | **2** | **-** | **2** | **1** | **-** | **1** | **2** | **-** |
| CO2-K5 | **3** | **1** | **3** | **-** | **2** | **3** | **-** | **-** | **1** | **2** | **-** | **1** |
| CO3-K5 | **2** | **2** | **-** | **2** | **1** | **2** | **2** | **3** | **1** | **-** | **2** | **-** |
| CO4-K5 | **2** | **1** | **2** | **1** | **2** | **3** | **-** | **2** | **-** | **2** | **1** | **2** |
| CO5-K5 | **3** | **3** | **1** | **1** | **2** | **2** | **-** | **1** | **1** | **2** | **2** | **-** |

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| **S.NO** | **GRADUATE ATTRIBUTION** | **ACTION VERBS** | **LEVEL** |
| 1 | ENGINEERING KNOWLEDGE | APPLY, ANALYZE | K3,K4 |
| 2 | PROBLEM ANALYSIS | ANALYZE | K4 |
| 3 | DESIGN DEVELOPMENT OF SOLUTIONS | EVALUATE | K5 |
| 4 | INVESTIGATION OF COMPLEX PROBLEMS | APPLY, ANALYZE, EVALUATE | K3,K4,K5 |
| 5 | MODERN TOOL USAGE | APPLY, EVALUATE | K3,K5 |
| 6 | ENGINEER AND SOCIETY |  |  |
| 7 | ENVIRONMENT AND SUSTAINABILITY |  |  |
| 8 | ETHICS |  |  |
| 9 | INDIVIDUALS AND TEAM WORK | ANALYZE, EVALUATE | K3,K4 |
| 10 | COMMUNICATION |  |  |
| 11 | PROJECT MANAGEMENT AND FINANCE  | APPLY | K3 |
| 12 | LIFE LONG LEARNING | CREATE | K6 |

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| ***Course Objectives:*** |
| * ***To give concepts of Principal stresses and strains developed in cross section of the beams on the cross section and stresses on any inclined plane. To impart concepts of failures in the material considering different theories***
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| * ***To give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs and design the cross section when subjected to loading using different theories of failures.***
 |
| * ***To classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions and to calculate combined effect of direct and bending stresses on different engineering structures. Perform calculations based on the observation.***
* ***Introduce the concept of unsymmetrical bending in beams Location of neutral axis Deflection of beams under unsymmetrical bending.***
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| **Text books:** |
| ***1. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi*** |
| ***2. Strength of materials by R. K. Bansal, Lakshmi Publications.*** |
| **Reference Books :** |
| 1. ***Mechanics of Materials- by R. C.Hibbler, Pearson publishers***
2. ***Mechanics of Solids  E P Popov, Prentice Hall.***
3. ***Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3rd Edition, Universities Press,***
4. ***Mechanics of Structures Vol  I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd***
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