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**Department of Mechanical Engineering,**

**School of Engineering,**

**University of Management and Technology**

**Course Outline**

**Course code: ME 221 Course title: Mechanics of Material-1**

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| Program | BSME |
| Credit Hours | 3 |
| Duration | One semester |
| Learning Methodology: | Online lectures, problem solving exercises |

**Course Learning Outcomes:**

At the end of the course students should be able to:

1. **Explain** stress-strain behavior of materials and their mechanical properties. (C2)
2. **Solve** engineering problems for statically determinate and indeterminate structures under axial loading. (C4)
3. **Analyze** mechanical structures for stresses and deflection in bending application and circular shaft for stresses and angle of twist in torsion applications. (C4)

**Mapping of CLOs to Program Learning Outcomes (PLOs):**

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| **Semester** | **Course Code** | **Title** | **Course Learning Outcomes** | **PLO 1**Engg . Knowledge | **PLO 2**Problem Analysis | **PLO 3**Solution Design | **PLO 4**Investigation | **PLO 5**Mod. Tool Usage | **PLO 6**Engr. & Society | **PLO 7**Env. &Sust. | **PLO 8**Ethics | **PLO 9** Team Work | **PLO 10**Communication | **PLO 11**Proj. Mgmt. | **PLO 12**Lifelong Learning |
| **Eight** | **ME 432** | **Power Plants** | **Explain** stress-strain behavior of materials and their mechanical properties. (C2) | ✓ |  |  |  |  |  |  |  |  |  |  |  |
| **Solve** engineering problems forstatically determinate and indeterminate structures under axial loading. (C4) |  | ✓ |  |  |  |  |  |  |  |  |  |  |
| **Analyze** mechanical structures for stresses and deflection in bending application and circular shaft for stresses and angle of twist in torsion applications. (C4) |  | ✓ |  |  |  |  |  |  |  |  |  |  |

**Lecture wise Teaching Plan**

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| **Lectures** | **Topics** | **Textbook Chapter(s)** | **CLOs** |
| 1 | Concept of stress and strain: Normal stress and normal strain under axial loading: Shear stress and shear strain. | 1, 2 | 1 |
| 2 | Mechanical properties of materials: Stress-strain diagrams of ductile materials. Residual stresses. | 2 | 1 |
| 3 | Hooke’s law: Strain energy: Poisson’s ratio. | 2 | 1 |
| 4 | Deformation of members under axial load: Statically determinate problems: | 2 | 1, 2 |
| 5 | Deformation of members under axial load: Statically indeterminate problems: | 2 | 1, 2 |
| 6 | Thermal stresses and strain in the rod. | 2 | 1, 2 |
| 7 | Stress Concentration under axial loading: | 2 | 1, 2 |
| 8-9 | Stresses in thin walled pressure vessels. | 7 | 1, 2 |
| 10 | Simple theory of bending, | 4 | 3 |
| 11 | Shear force diagrams. | 5 | 3 |
| 12 | Bending moment diagrams. | 5 | 3 |
| 13-14 | The flexure formula, Bending stresses in beams. | 4 | 3 |
| 15 | **Midterm Exam *(tentative)*** |  |  |
| 16 - 17 | Shear stresses in beams | 6 | 3 |
| 18 - 19 | Deflection of beams –Direct Integration method. | 9 | 3 |
| 20 - 21 | Deflection of beams –Macaulay’s methods. | 9 | 3 |
| 22 - 23 | Design of beam for bending | 5 | 3 |
| 24 | Torsion: Torsional deformation of circular shafts | 3 | 3 |
| 25-26 | Torsion: Torsion formula. | 3 | 3 |
| 27 | Torsion: Angle of twist. | 3 | 3 |
| 28 | Torsion: Power transmitted by shafts. | 3 | 3 |
| 29-30 | Design of transmission shafts. | 3 | 3 |
| 31 | **Final Exam** |  |  |

**Textbook:**

Ferdinand P. Beer, E. Rullel Johnston and John T. DeWolf. Mechanics of Materials, 7th edition, McGraw Hill Education, 2014. ISBN: 978-0073398235

**Reference Books:**

Benham P.P. & Crawford R.J. Mechanics of Engineering Materials, 5th edition, Pearson Prentice Hall, 1996.

James M. Gere. Mechanics of Materials, 7th edition, Cengage Learning, 2008.

R.C. Hibbeler. Mechanics of Materials, 8th edition, Prentice Hall, 2010.

**Calculator:**

The course requires extensive calculations. All participants are required to bring a scientific calculator.

**Grade Evaluation Criteria**

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| --- | --- |
| **Components** | **Marks** |
| Assignments | 5 |
| Quiz | 5+5+5 |
| Mid Term Exam | 30 |
| Final Exam | 50 |
| Total | 100 |