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MECHANICS OF MATERIALS

COURSE INFORMATION

by

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MECHANICS OF MATERIALS

- SUBJECT CODE : BAA 1133
- CREDIT HOURS : 3
- CONTACT HOURS : 3
- PRE-REQUISITE : Yes



Synopsis

This course introduces :

The aims of this course are the study of the behavior of engineering or structural elements subjected to loads. It provides an introduction on elastic stress and strain analysis, axial deformations and analysis of column. Thus, properties and behavior of engineering materials including stress-strain relations will be analyzed. This course also deals with the analysis of direct and torsional shear stresses and their deformation; shear force and bending moment of beam also the stresses in beams; transformations of stresses.



Course Outcome

By the end of this course, students should be able to:

- CO1: Identify the stresses, strain and deformation in response to external loading as well as principle stresses in plane
- CO2: Analyze the state of stresses, strains in axially-loaded member, also mechanical behavior of materials under load
- CO3: Analyze the bending and shear stress in determinate beams from shear-moment diagrams
- CO4: Determine the stresses, deformation and twist of angle of a torsional bar
- CO5: Determine the magnitude of the critical load of buckling column

Course Contents

- CHAPTER 1 : Analysis of Stress
- CHAPTER 2 : Analysis of Strain
- CHAPTER 3 : Mechanical Properties of Materials
- CHAPTER 4 : Axial Load
- CHAPTER 5 : Analysis of Beams for Bending
- CHAPTER 6 : Shearing Stress in Beam
- CHAPTER 7 : Transformation of Stress and Strain
- CHAPTER 8 : Torsion
- CHAPTER 9 : Analysis of Column



ANALYSIS OF STRESS

1.1

- State of stresses – concept of force, stress, normal stress and shear stress

1.2

- Average normal stress in an axially loaded bar

1.3

- Average shear stress

1.4

- Allowable stress

ANALYSIS OF STRAIN

2.1

- Introduction on deformation

2.2

- Analysis of strain

MECHANICAL PROPERTIES OF MATERIALS

- 3.1 • Introduction on stress – strain diagram
- 3.2 • Behavior of materials
- 3.3 • Hooke's Law concept
- 3.4 • Poisson's ratio
- 3.5 • Shearing strain

AXIAL LOAD

4.1

- Introduction on deformation in axially loaded bar

4.2

- Saint – Venant’s principle

4.3

- Elastic deformation of an axially loaded statically determinate member

4.4

- Elastic deformation of an axially loaded statically indeterminate member

4.5

- Elastic deformation of member due to thermal stress

ANALYSIS OF BEAMS FOR BENDING

5.1

- Introduction on shear force and bending moment in a beam

5.2

- Analysis on shear force and bending moment in the beam

5.3

- Draw the shear force and bending moment diagrams in a beam

5.4

- Introduction on pure bending in a beam

5.5

- Stresses in the elastic range in a beam

5.6

- Analysis of pure bending in a beam

SHEARING STRESS IN BEAM

6.1

- Introduction on shear stress in a beam

6.2

- Analysis of shear stress in a beam / transverse shear

TRANSFORMATION OF STRESS AND STRAIN

7.1

- Introduction on transformation of plane stress

7.2

- General equations of plane-stress transformation

7.3

- Principal stresses and maximum in- plane shear stress

7.4

- Introduction on Mohr's circle

7.5

- Mohr's circle for plane stress

TORSION

8.1

- Introduction on torsional

8.2

- Torsional deformation of a circular shaft

8.3

- Stresses in the elastic range

8.4

- Torsion formula

8.5

- Angle of twist

ANALYSIS OF COLUMN

9.1

- Concept of Stability of Column

9.2

- Failure Mode of Column

9.3

- Influence of Support Conditions

9.4

- Magnitude of the load at which buckling occur

References

1. Hibbeler, R.C., Mechanics Of Materials, 9th Edition in SI units, Prentice Hall, 2013.
2. Ferdinand P. Beer, E. Russell Johnston, Jr., John T. DeWolf, David F. Mazurek, Mechanics of materials 5th Edition in SI Units, McGraw Hill, 2009.
3. Michael E. Plesha, Gary L. Gray, Francesco Costanzo, Engineering Mechanics, McGraw Hill

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