**Course Title:**       Strength of Materials-II (CE-302)

**Pre-requisite(s):**   Engineering Mechanics, Strength of Materials-I

**Credit Hours:**   3 + 1

**Contact Hours:**   3 + 3

**Text Book(s):**   **1.**Craig, R. R. (2011) *Mechanics of   Materials*, 3$^{rd}$ edition, John Wiley and Sons, ISBN 978-0-470-48181-3

**2.**Beer, F. P., E. R. Johnston, J. T. DeWolf, and D. F. Mazurek (2011) *Mechanics of Materials,* 6th edition, McGraw Hill, ISBN 007-124999-0

**3.** Hibbeler, R. C. (2011) Mechanics of Materials, 8$^{th}$ eidtion, Prentice Hall, ISBN 978-0-13-602230-5

**Reference Book(s):1.** Gere, J. M., and B. J. Goodno (2012) Mechanics of Materials, Brief edition, Cenage Learning, ISBN 978-1-111-13603-1

**2.** Case, J., L. Chilver, and C. T. F. Ross (1999) *Strength of Materials and Structures,* 4$^{th}$ edition, Edward Arnold, ISBN 0-340-71920-6

**3.** Pytel, A., F. L. Singer (1987) *Strength of Materials*, 4th Edition, Harper International, ISBN 0-06-045313-3

**4.** Warnock, F. V., P. P. Benham, and R.J. Crawford (1980) Mechanics of Engineering Materials, ELBS, ISBN 0-582-25363-2

**Catalog Data:**
Stress and strain transformation, principal stress, Mohr's circle, flexural and shear stress distribution, shear center, combined loadings, theories of failure, Euler's buckling

**Course Objectives:**

The objective of the study of strength of materials is to provide the student/engineer with methods of analysing various structural members in terms of determination of stresses and strains so that a given structure can be safely designed and/or analysed under the applied loading conditions.

**Course Learning Outcomes:**

At the end of this course, the student will:

CLO 1: Understand the fundamental concepts of stress and strain transformation; principle planes, stresses and strains; and maximum, minimum shear stresses and strains using analytical and graphical approaches of solution.

CLO 2: Able to analyse symmetrical and unsymmetrical bending behaviour of beams; shear stress distribution, shear flow and shear centre of thin walled open sections.

CLO 3: Able to analyse various types of structural members (beams, columns, circular shafts) subjected to axial loads, transverse shear, torsion, bending, and combined loading effects.

CLO 4: Understand different failure criteria/theories for designing of safe structural members.

CLO 5: Understand buckling instability of columns

**Course Contents:**

Analysis of stress at a point due to combined effect of axial force, shear force, torsion and bending moment, stress and strain transformation, principal stresses and maximum shear stresses, Mohr's circle for stresses and strains, strain rosettes, relationship between elastic constants, symmetrical and unsymmetrical bending of beams, eccentrically loaded columns, theories of failure, shear stress distribution in beams and shear center

**Grading Policy:**

| Sr. No. | Grading | % of Total Marks |
|---------|---------|------------------|
| 1 | Assignments | 10 % |
| 2 | Quizzes | 10% |
| 3 | Lab work | 20% |
| 4 | Midterm Exam | 20% |
| 5 | Final Exam | 40% |

**Student Learning Outcomes:**

The student, upon successful completion of this course, will be able to:

- Understand and able to work with complex states of stress and strain using analytical and graphical (Mohr's circle) solutions
- Determine principal stresses and strains as well as maximum, minimum shear stresses and strains
- Calculate strains and stresses for axial, torsion, transverse shear, bending, and combined loading effects
- Understand the relationships between working stress, material strength and factor of safety in the light of different theories of failure
- Understand and calculate stresses of symmetrical/unsymmetrical sections of beams under symmetrical and unsymmetrical bending effects
- Calculate shear stresses and their distribution in thin walled open section beams and able to locate shear centre
- Understand the concepts of Euler buckling calculation and able to calculate failure loads for eccentrically loaded columns

**Course Professional Outcome/Industrial Usage:**

After the completion of this course, student will be able to understand the behavior of materials under various types of loading conditions which will help him in analyzing and designing safer structures.

| CLO's / PLO's | CLO 1 | CLO 2 | CLO 3 | CLO 4 | CLO 5 |
|---|---|---|---|---|---|
| PLO 1 (Engineering Knowledge) | ✔ | ✔ | ✔ | ✔ | ✔ |
| PLO 2 (Problem Analysis) | ✔ | ✔ | ✔ | ✔ | ✔ |
| PLO 3 (Design/Development of Solutions) | | | ✔ | ✔ | |
| PLO 4 (Investigation) | ✔ | ✔ | | | |
| PLO 5 (Modern Tool Usage) | ✔ | | ✔ | | |
| PLO 6 (The Engineer and Society) | | | ✔ | ✔ | |
| PLO 7 (Environment and Sustainability) | | | | | |
| PLO 8 (Ethics) | | | | | |
| PLO 9 (Individual and Team work) | | | | | |
| PLO 10 (Communication) | | | | | |
| PLO 11 (Project Management) | | | | | |
| PLO 12 (Lifelong Learning) | ✔ | | ✔ | ✔ | |

| CLOs / Assessment Modules | CLO 1 | CLO 2 | CLO 3 | CLO 4 | CLO 5 |
|---|---|---|---|---|---|
| Assignments | ✔ | ✔ | ✔ | ✔ | ✔ |
| Quizzes | ✔ | ✔ | ✔ | ✔ | ✔ |
| Mid-semester Exam | ✔ | | ✔ | | |
| Final Exam | ✔ | ✔ | ✔ | ✔ | ✔ |