

IIT Mandi
Proposal for modifying existing course

Course number	: CE310
Name	: Strength of Materials and Structures
Credit	: 3
Distribution	: L-T-P-C 3-0-0-3
Intended for	: UG Program
Prerequisite	: IC240: Mechanics of Rigid Bodies
Mutual Exclusion	: -

1. Preamble:

The design of structural systems is based on the applied external loads and strength of the materials. Hence, it is critical for an engineer to have a holistic knowledge of the behaviour of structural materials. This course will provide an understanding of different loads that could act upon a structure, the different materials that are used in building a structure, and an understanding of the corresponding strength condition and the supports typically provided for a structure. Students will be exposed to the application of conventional theories and methods that can be facilitated to estimate forces, reactions, and deflection of structural systems. The course focuses on the basic techniques of structural analysis for determinate trusses, cables, arches, beams, and frames. The contents have been developed to include the fundamentals of material performance and topics of force and deflection analysis with a special emphasis on statically determinate structures.

2. Course Modules with quantitative lecture hours:

Module 1: Introduction to loads, structural materials, and support conditions, (3 Hours)
Overview of internal and external stability, Definition of determinate structures.

Module 2: Mechanics of small deformation: Free Body Diagram, Concepts of stress (8 Hours)
and strain - types and definition, stress-strain characteristics of ductile and brittle materials, elastic constants and their relationships, Axially loaded members, Concept of Torsion and Torsional behaviour of circular shafts

Module 3: Transformation of stresses and strains, principal stresses and strains, (5 Hours)
Mohr's circle, and Failure theories

Module 4: Determination of external and internal forces in Trusses, Cables, Arches, (10 Hours)
and Beams, Concept of shear force, and bending moment diagrams of determinate beams and frames.

Module 5: Flexural and shear stresses in beams, deflections of beams using double (8 Hours)
integration, introduction to moment area, unit load, and conjugate beam methods.

Module 6: Influence lines for statically determinate structures; Moving loads on (4 Hours)
beams and trusses; Maximum shear force and bending moment due to moving loads.

Module 7: Columns: Euler's theory, Critical load for different end conditions, (4 Hours)
eccentric loading, columns with small initial curvatures.

Laboratory/practical/tutorial Modules: -

3. Text books:

1. Hibbeler, RC, Structural Analysis, Pearson Education, 9th edition, New Delhi, 2017.
2. Hibbeler, RC, Mechanics of Materials, Pearson Education, 10th edition, New Delhi, 2016.

4. References:

1. Timoshenko, S.P., and Young, D.H., Elements of Strength of Materials, 5th Edition, 2003.
2. Beer, F.P., Johnston, E.R., DeWolf, J, and Mazurek, D.F., Engineering Mechanics of Solids by Egor P. Popov, 2nd Edition Pearson Education Inc, 2009
3. Gere and Timoshenko, Mechanics of Materials, 2nd Edition, CBS Publishers, 2004.
4. Reddy, CS, Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2001.
5. Menon, D, Structural Analysis, Narosa Publishing House, 2008.
6. Ross, C.T.F, Case, J, and Chivler, L, Strength of Materials and Structures, 4th edition, Butterworth Heinemann, UK, 1999.
7. Megson, THG, Structural and Stress Analysis, Butterworth-Heinemann, UK and USA, 2014.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	-	-	-	-

6. Justification of new course proposal if cumulative similarity content is >30%:

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