

Course Template: Solid Mechanics (AML 180)

1.	Department/Centre	Applied Mechanics
2.	Course Title	Solid Mechanics
3.	Course No.	AML 180
4.	L-T-P structure	3-1-2
5.	Credits	5
6.	Status of the course	Elective/Core for UG Programs
7.	Prerequisite for the course	AML110
8.	Status vis-à-vis other courses	
8.1	Overlap with any UG/PG Course of the Dept./Centre	AML140, AML150, AMP262
8.2	Overlap with any UG/PG Course of other Dept./Centre	Nil
8.3	Supercedes any existing course	No
9.	Not allowed For	NIL
10.	Frequency of offering	Both/Either Semester
11.	Faculty will teach the course	All Solids Faculty.
12.	Will the course require visiting faculty	No
13.	Course Objectives: This course will introduce the students to the basic concepts of mechanics of deformable media: concept of stress tensor, strain tensor, strain rates, constitutive relations, and applications to one/two dimensional problems.	
14.	Course Content: Introduction, State of stress at a point, equations of motion, principal stress, maximum shear stress. Concept of strain, strain displacement relations, compatibility conditions, principal strains, transformation of stress/strain tensor, state of plane stress/strain. Constitutive relations, uniaxial tension test, idealized stress-strain diagrams, isotropic linear elastic, viscoelastic and elasto-plastic materials. Energy Methods. Uniaxial stress and strain analysis of bars, thermal stresses, Torsion, Bending and shear stresses in beams, deflection of beams, stability of equilibrium configuration.	

15.	Lecture Outline (with topics and number of lectures)	
SN.	Topic	No. of hrs
i	Introduction, state of stress at a point, equations of motion, principal stress, maximum shear stress.	6
ii	Concept of strain, strain displacement relations, compatibility conditions, principal strains, transformation of stress/strain tensor, state of plane stress/strain.	5
iii	Constitutive relations, uniaxial tension test, idealized stress-strain diagrams, isotropic linear elastic, viscoelastic and elasto-plastic materials.	4
iv	Energy Methods.	3
v	Uniaxial stress and strain analysis of bars, thermal stresses.	2
vi	Torsion of circular bars and thin walled members	6
vii	Bending of straight/curved beams, transverse shear stresses, deflection of beams	12
viii	Stability of equilibrium configuration	4
	Course Total	42
16.	Brief description of tutorial activities	
	Tutorial problems based on concepts taught in the class will reinforce the understanding of concepts. The set of problems on concept of stress/strain tensors, constitutive relation, energy methods, uniaxial stress/strain in bars, bending and deflection of beams, torsion of shafts, buckling etc will be dealt.	
17.	Brief description of laboratory activities: The following experiments will be conducted to reinforce/augment the concepts of solid and fluid mechanics-	
SN.	Experiment Description	Hours
i	Stress-Strain curve using standard tension specimen	4
ii	Brinell and Rockwell hardness tests	4
iii	Izod and Charpy impact tests	4
iv	Strain measurement using electrical resistance strain gauges	4
v	Compression and Buckling tests	4
vi	Torsion tests on standard steel specimen	4
vii	Photoelastic Stress Analysis	4
	Total	28

18.	Suggested Text and Reference Material	
	1. Introduction to Solid Mechanics by I. H. Shames and J. M. Pitarresi, Prentice Hall of India. 2. Mechanics of Materials by F. P. Beer, E. R. Johnston, J. T. Dewolf and D. F. Mazurek, Tata McGraw Hill. 3. Advanced Mechanics of Solids by L. S. Srinath, Tata McGraw Hill. 4. Mechanics of Solids by S. H. Crandall, N. C. Dahl and T. J. Lardner, Tata McGraw Hill. 5. Mechanics of Solids by A. K. Singh, Prentice Hall of India. 6. Solid Mechanics by S. M. A. Kazimi, Tata McGraw Hill. 7. Mechanics of Solids by S. H. Crandall, N. C. Dahl and T. J. Lardner, Tata McGraw Hill. 8. Experimental Stress Analysis by James W. Dally and W.F. Riley, McGraw Hill. 9. History of Strength of Materials by S. P. Timoshenko, Dover Publications.	
19.	Resources required for the course	
19.1	Software	Matlab/Mathematica
19.2	Hardware	Equipments available in solid mechanics labs
19.3	Teaching aides (videos etc.)	Nil
19.4	Laboratory	Solid lab
19.5	Equipment	Available in solid mechanics lab
19.6	Classroom infrastructure	Projection system
19.7	Site visits	Nil
20.	Design Content of the course	
20.1	Design type problems	20 %
20.2	Open-ended problems	5 %
20.3	Project-type activity	5 %
20.4	Open-ended laboratory work	Nil
20.5	Others (please specify)	Nil

Date:

(Signature of the Head of the Department)