Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Mechanical Engineering

BME303-MECHANICS OF SOLIDS
THIRD SEMESTER, 2015-16 (odd semester)

Course (catalog) description

To gain knowledge of simple stresses, strains and deformation in components due to external loads. To assess stresses and deformations through mathematical models of beams twisting bars or combinations of both.

Compulsory/Elective course : Compulsory

Credit & contact hours : 4 & 60

Course Coordinator : MR.R.SHARAVANAN

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
R.Sharavanan	2A	JR101		sharavananr.mech@bharathuniv.ac.in	11.40 to 12.30 pm
S. Manavalan	2B	JR102		manavalan.mech@bharath.univ.ac.in	2.20 to 3.10 pm
J. Manikandan	2C	JR103		manikandan.mech@bharathuniv.ac.in	10.50 to 11.30 am

Relationship to other courses:

Pre –requisites **:** MECHANICS OF SOLIDS

Assumed knowledge : *Mechanical Properties of materials*
Following courses :

Syllabus Contents

UNIT I TRUSSES, SHEAR FORCE AND BENDING MOMENT DIAGRAM 12 HOURS

Analysis of trusses – Method of joints – Method of section – Shear force and Bending moment diagram – cantilever – simply supported – overhanging beams, Relation between load, shear force and bending moments.

UNITII STRESS AND STRAIN BEHAVIOUR OF SOLIDS **12 HOURS**

Tension, Compression and shear, Normal stress and strain, Statically indeterminate problems – temperature effects – stress and strain diagram – Elasticity – Plasticity, strain energy in tension – Impact loads – Shear stress and strain – Allowable stress – Poisson's ratio – Relation between elastic constants.

PRINCIPAL STRESSES Principal stresses and maximum shear stress – importance of zero principal stress in a three dimensional state of stress – Solution to problems by analytical method, Calculation of principal stress and maximum shear stress for a pressure vessel and shaft.

UNIT III BENDING & TORSION **12 HOURS**

Normal and shear stresses in beams – Torsion of circular shafts – Statically indeterminate torsional members – Torque diagrams, Strain energy in torsion.

UNIT IV DEFLECTION OF BEAMS **12 HOURS**

Slope and deflection of beams – Double integration method – Macaulay's method – Strain energy method for cantilever, simply supported and overhanging beams.

UNIT V THIN AND THICK CYLINDERS **12 HOURS**

Thin cylinder and shells – Volumetric strain – rotational stress in thin cylinders and discs, Thick cylinders – Shrink fit – Compounding of cylinders.

COLUMN AND STRUTS Columns and struts – Eccentric loading of short struts – Euler's Formula – Limitations of Euler's formula – Rankine – Gordon formula – Johnson's Parabolic formula.

Total: 60 HOURS

Text book(s) and/or required materials

TEXT BOOKS

1. Prabhu T.J. – Mechanics of Solids, 2009

REFERENCES

1. Gere Timoshenko – Mechanics of materials – CBS, 1997.

2. Beer & Johnson – Mechanics of materials, SI Metric Edition – McGraw Hill, ISE, 2006.

3. Timoshenko & young, Engineering Mechanics – McGraw Hill, 2007.

4. Popov E.P. Engineering Mechanics of solids – PHI, New Delhi, 2006.

5. Shames Irvin. H – Introduction to Solid Mechanics – PHI,2002

6. www.freeengineeringbooks.com/Civil/**Mechanics-of-Solids**-Books.php

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area: Load on Beams and structures

TEST SCHEDULE

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 28	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping Of Instructional Objectives With Program Outcome

		Correlates to program outcome		
		H	**M**	**L**
1.CO1	Upon completion of this course, the students can able to apply mathematical knowledge to calculate shear force & Bending moment diagram	a,b,k,l	h,i	c
2.CO2	Understand stress and strain behavior of solids	a,b,k,l	h,i	c
3.CO3	Understand and analyze stress behavior.	a,b,k,l	h,i	c
4.CO4	analyze the deflection in beams	a,b,k,l	h,i	c
5.CO5	Understand thick and thin cylinder	a,b,k,l	h,i	c
6.CO6	Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.	a,b,k,l	h,i	c

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
SESSION	**UNIT-1-TRUSSES, SHEAR FORCE AND BENDING MOMENT DIAGRAM**		
1.	Introduction	NO	[T1] chapter - 6, [T3] chapter - 4
2.	Analysis of trusses, method of joints, method of section	NO	
3.	Shear force and bending moment diagram	NO	
4.	Cantilever beam, simply supported beam	NO	
5.	Relation between load, shear force and bending moment	NO	
6.	Problems on analysis of trusses	YES	
7.	Derivation of SFD and BMD diagrams	YES	
8.	Problems on cantilever beam	YES	
9.	Problems on simply supported beam	YES	
10.	Problems on simply supported beam	YES	
11.	Problems on overhanging beam	YES	
12.	Problems on overhanging beam	YES	
	UNIT-2-STRESS AND STRAIN BEHAVIOR OF SOLIDS		
13.	Introduction	NO	[T1] chapter - 10, [R2] chapter - 6
14.	Tension, compression and shear, normal stress and strain	NO	
15.	Tension, compression and shear, normal stress and strain	YES	
16.	Statically indeterminate problems	YES	
17.	Statically indeterminate problems	YES	
18.	Temperature effect	NO	
19.	Stress and strain diagram	NO	
20.	Elasticity, plasticity, strain energy in tension	NO	
21.	Impact load, shear stress and shear strain	NO	
22.	Allowable stress, poisons ratio, Relation between elastic constant	NO	
23.	Principal stress and maximum shear stress problem by analytical method	YES	

24.	Calculation of principal stress and maximum shear stress for a pressure vessel and shaft	YES	
	UNIT-3-BENDING AND TORSION		
25.	Introduction	NO	T1,T2
26.	Normal and shear stress in beams	NO	
27.	Normal and shear stress in beams	NO	
28.	Torsion of circular shaft	NO	
29.	Torsion of circular shaft	YES	
30.	Statically indeterminate torsional members	NO	
31.	Statically indeterminate torsional members	YES	
32.	Torque diagrams	NO	
33.	Torque diagrams	NO	
34.	Problems on torque diagram	YES	
35.	Strain energy in torsion	NO	
36.	Strain energy in torsion	YES	
	UNIT-4-DEFLECTION OF BEAMS		
37.	Introduction	NO	T1,T3,T4
38.	Slope and deflection of beam	NO	
39.	Slope and deflection of beam	YES	
40.	Double integration method	NO	
41.	Double integration method, Macaulay's method	YES	
42.	Macaulay's method	YES	
43.	Strain energy method for cantilever, simply supported and over hanging beans	NO	
44.	Strain energy method for cantilever beam	YES	
45.	Strain energy method for cantilever beam	YES	
46.	Strain energy method for simply supported beam	YES	
47.	Strain energy method for simply supported beam	YES	
48.	Strain energy method for overhanging beam	YES	
	UNIT-5- THIN AND THICK CYLINDERS		
49.	Introduction	NO	T1,T4
50.	Thin cylinder and shell, volumetric strain	NO	
51.	Rotational stress in thin cylinders and disc	YES	
52.	Thick cylinder, shrink fit, compounding of cylinders	NO	

53.	Thick cylinder, shrink fit, compounding of cylinders	YES	
54.	Column and struts	NO	
55.	Column and struts	YES	
56.	Eccentric loading of short struts, Euler's formula	YES	
57.	Limitation of Euler's formula	YES	
58.	Rankine , Gordon formula, Johnson's parabolic formula	YES	
59.	Rankine , Gordon formula, Johnson's parabolic formula	YES	
60	Rankine , Gordon formula, Johnson's parabolic formula	YES	

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment / Seminar / Online Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by Mr.Sharavanan

Addendum

ABET Outcomes expected of graduates of B.Tech / MECH / program by the time that they graduate:

a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) The ability to identify, formulate and solve engineering problems.

c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) The ability to design and conduct experiments, as well as to analyze and interpret data

e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

f) The ability to apply reasoning informed by the knowledge of contemporary issues.

g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

h) The ability to understand professional and ethical responsibility and apply them in engineering practices.

i) The ability to function on multidisciplinary teams.

j) The ability to communicate effectively with the engineering community and with society at large.

k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) The ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION:
Mechanical Engineering graduatesare enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

PEO2: CORE COMPETENCE:
Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:
Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: PROFICIENCY:
Mechanical Engineering graduates became skilled to afford training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:
Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

Course Teacher	Signature
R.Sharavanan	
S. Manavalan J. Manikandan	

Course Coordinator **HOD/MECH**

R.Sharavanan