PSN College of Engineering and Technology
(Autonomous)
Tirunelveli - 627152

Course File

Subject Code	: **ME 630204**
Subject Name	:**STRENGTH OF MATERIALS**
Regulation	: REGULATION 2022
Semester	: III
Academic Year	: 2024 – 2025 (Odd Semester)
Department	: Mechanical Engineering
Degree &Programme	: B.E. Mechanical Engineering

Prepared By

Name	: **Dr.Y.Carlin Calaph**
Designation	: Associate Professor
Department	: Mechanical Engineering

Course File Verification and Auditing

Part-I

(At the beginning of the semester)

Submission Date	Check List								Verified by HOD	Verified by Academic Auditor
	Vision and Mission	Course Description, Objective and Outcomes	CO-PO mapping	Course Plan and Target	Syllabus and Content beyond Syllabus	Assignments & additional resources	Course Delivery Plan	University Question Papers		

Part-II

(After CAT - I)

Submission Date	Check List					Verified by HOD	Verified by Academic Auditor
	Syllabus Coverage	Notes and Other Materials	Performance Analysis	Feedback	Proof for Participatory Learning		

Part-III

(After CAT - II)

Submission Date	Check List					Verified by HOD	Verified by Academic Auditor
	Syllabus Coverage	Notes and Other Materials	Performance Analysis	Question Papers and Keys	Proof for Participatory Learning		

Part-IV

(After Model examination)

Submission Date	Check List					Verified by HOD	Verified by Academic Auditor
	Syllabus Coverage	Notes and Other Materials	Performance Analysis	Question Papers and Keys	Proof for Participatory Learning		

Semester Academic Audit

Audit Remarks:

Signature of the Auditor(s):

Signature of Director (Academics) Signature of Principal

Contents

PSN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, An ISO 9001:2015 Certified

Accredited by NAAC A^{+} in 3rd cycle

Melathediyoor, Palayamkottai (TK), Tirunelveli (DT), Pin: 627 152

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE PLAN

(Regulation 2022)

Version; 01 **ODD Semester** **Academic Year: 2024-2025**

Subject Name & Code	**STRENGTH OF MATERIALS & ME630204**
Course Type	**Theory with Practical Component Paper**
Programme	**B. E Mechanical Engineering**
Year/ Semester/ Section	**II / IIIrd**
Nature of Course / Credit	**Integrated / 3**
Course Coordinator	**Dr.Y.Carlin Calaph**

VISION AND MISSION OF THE INSTITUTE:

INSTITUTE VISION
To emerge as a pioneer institute inculcating engineering education, skills, research, values and ethics.
INSTITUTE MISSION
● To achieve greater heights of excellence in technical knowledge and skill development through innovative teaching and learning practices. ● To develop the state of art infrastructure to meet the demands of technological revolution. ● To improve and foster research in all dimensions for betterment of society. ● To develop individual competencies to enhance innovation, employability and entrepreneurship among students. ● To instill higher standards of discipline among students, inculcating ethical and moral values for societal harmony and peace.

VISION AND MISSION OF THE DEPARTMENT:

DEPARTMENT VISION
To emerge as a preeminent department to produce quality Mechanical Engineering Graduates to meet national and global needs.
DEPARTMENT MISSION
● To educate students to be creative, inquisitive and innovation to become quality engineer and entrepreneurs.

● To instil advanced knowledge with research capabilities for global careers and higher studies. ● To inculcate moral and ethical standards in life and career.

1. PRE-REQUISITES

- This subject requires, a complete description of the geometry of the member, its constraints, the loads applied to the member and the properties of the material of which the member is composed.

2. COURSE DESCRIPTIONS

- To impart knowledge about the various loads, stresses, strains, various types beams, loading of beams, theory of simple bending, deflection of beams, stresses in columns. To study about the torsion, springs and various types of cylinders.

3. CAREER OPPORTUNITIES:

- All the Engineering sectors, Production Engineers.
- Primarily for Mechanical, Mechanical and Automation, Aeronautical Engineering sectors.

4. SYLLABUS

<table>
<tr><td colspan="3">ME630204-StrengthofMaterials</td></tr>
<tr><td rowspan="2">Course Category: Program Core</td><td rowspan="2">Course Type: Theory with practical Component</td><td>
<table>
<tr><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>3</td></tr>
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<tr><td></td></tr>
<tr><td>COURSEOBJECTIVES:</td><td></td><td></td></tr>
<tr><td colspan="3">● To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.
● To verify the principles studied in theory by conducting the experiments.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="2">UNIT1: STRESS,STRAINANDDEFORMATIONOFSOLIDS</td><td>6</td></tr>
<tr><td colspan="3">Rigid bodies and deformable solids–Tension, Compression and Shear Stresses–Deformation of simple and compound bars–Thermal stresses–Elastic constants.</td></tr>
<tr><td colspan="2">UNIT2:TRANSVERSE LOADING ON BEAMS AND STRESSES INBEAM</td><td>6</td></tr>
<tr><td colspan="3">Beams–types transverse loading on beams–Shear force and bending moment in beams–Cantilevers –Simply supported beams.</td></tr>
<tr><td colspan="2">UNIT3:TORSIONANDSPRINGS</td><td>6</td></tr>
<tr><td colspan="3">Torsion formulation stresses and deformation in circular and hollows shafts–Stresses in helical springs –Deflection of helical springs.</td></tr>
<tr><td colspan="2">UNIT4:DEFLECTIONOFBEAMS</td><td>6</td></tr>
<tr><td colspan="3">Double Integration method and deflections in beams. –Area moment theorems for computation of slopes</td></tr>
<tr><td colspan="2">UNIT5:THINCYLINDERSANDSPHERES</td><td>6</td></tr>
</table>

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells.	
LISTOFEXPERIMENTS	**15**
1. Tension test on a mild steel rod 2. Compression test on wooden piece 3. Torsion test on mild steel rod 4. Deflection test on beams 5. Compression test on helical springs	
TOTAL:45PERIODS	
Course Outcomes: At the end of the course, the student will be able to	
CO1.Visualizetheconceptofstress, strain in various sections.	
CO2: Compute the shearing and bending of beams due to loading.	
CO3: Calculate the torsion stress and deflections on the springs.	
CO4: Recognize the deflection of beam when the stress is acted.	
CO5: Analyze the stress on columns & thin cylinders and know the application of theories of failure problems.	

CO's	CO - STATEMENTS	Bloom's Level	PO's
CO1	Visualize the concept of stress, strain in various sections	K1,K2	1,2,3,4,12
CO2	Compute the shearing and bending of beams due to loading	K1, K3	1,2,3,4,12
CO3	Calculate the torsion stress and deflections on the springs	K2, K4	1,2,3,4,7,12
CO4	Recognize the deflection of beam when the stress is acted	K4, K5	1,2,3,4,12
CO5	Analyze the stress on columns &thin cylinders and know the application of theories of failure problems	K1,K2,K4	1,2,3,4,12

6. INSTRUCTIONAL LEARNING OUTCOMES

UNIT	LEARNING OUTCOMES
I	Students will learn about the fundamental concepts of stress and strain. This outcome will be assessed through Assignment – 1, Class Test – 1,CAT-I and MCQ.
II	Students will learn about the concepts Transverse loading of beam and various beams. This outcome will be assessed through assignment – 2, class Test – 2, CAT-I and MCQ.
III	Students will learn the torsion and spring in various types of shafts. This outcome will be assessed through assignment – 3, class Test – 3 and CAT-II and MCQ.
IV	Students will learn various methods to determine the deflection in beams. This outcome will be assessed through assignment – 4, class Test – 4 and CAT-II and MCQ.
V	Students will learn the principles about thin cylinder. This outcome will be assessed through assignment – 5, class Test – 5, CAT –II and MCQ.

7. PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
Sl. No.	**PEOs**
PEO1	The Graduates of Mechanical Engineering program will excel in technical

	knowledge, innovation and entrepreneurial skills.
PEO2	The Graduates will be able to design and develop various Mechanical Systems for interdisciplinary and multi-disciplinary applications.
PEO3	The Graduates will exhibit ethical attitude, human values, leadership quality and ability to solve engineering problems to a broader social context.

8. PROGRAM OUTCOMES [PO's]

PROGRAM OUTCOMES			
PO'S No.	**KNOWLEDGE**	**STATEMENT**	**APPLIANCE**
1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of Complex engineering problems.	Theory/ Practical / Project work
2	Problem Analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	Theory / Practical / Projects
3	Design / Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the needs with appropriate consideration for the public health and safety, and the cultural, Societal and environmental considerations.	Theory / Practical / Projects
4	Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Theory / Practical
5	Modern Tool usage	Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	Theory / Practical / Project work
6	The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	Theory / Industrial visit / In plant training
7	Environment and Sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.	Theory / Industrial Visit/ In plant Training
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	Theory / Industrial visit / In plant training

9	Individual and Team Work	Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.	Projects
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.	Projects/ Seminar/ Mini Project
11	Project Management and Finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Projects
12	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Projects / Higher Studies

9. PROGRAMME SPECIFIC OBJECTIVE (PSO's)

PROGRAM SPECIFIC OUTCOMES (PSOs)
PSO1: To Prepare Mechanical Engineering Graduates with an outstanding knowledge of industrial automation for a successful career **PSO2:** To develop an ability to accept global challenges and apply engineering knowledge for solving various problem in the area of mechanical engineering using computer aided engineering

10. CO – PO MAPPING

Sl. NO.	COURSE OUTCOME	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Visualize the concept of stress, strain in various sections	3	2	1	2	-	-	-	-	-	-	-	2	-	-
CO2	Compute the shearing and bending of beams due to loading	3	2	1	2	-	-	-	-	-	-	-	2	-	-
CO3	Calculate the torsion stress and deflections on the springs	3	2	1	2	-	-	2	-	-	-	-	2	-	-
CO4	Recognize the deflection of beam when the stress is acted	3	1	2	1	-	-	-	-	-	-	-	2	-	-
CO5	Analyze the stress on columns & thin cylinders and know the application of theories of failure problems	3	1	2	1	-	-	-	-	-	-	-	2	-	-

11. TEXT BOOK & REFERENCE BOOK LIST

Sl. No	Description	Legend
Text Book(s):		

1	R.K. Bansal, "Strength of Materials", Laxmi Publications, New Delhi,2001, Revised 4th edition,2010	T1
2	R.K. Rajput, "Strength of Materials", Chand and Company Limited, New Delhi	T2
Reference Book(s):		
1	Jindal U.C., "Strength of Materials", Galgotia Publication, New Delhi, II Edition,2008.	R1
2	Ryder G.H., "Strength of Materials", Macmillan, Delhi, 2003, 3RDEdition.	R2
3	Sadhu Singh, "Strength of Materials", Khanna Publishers, New Delhi, 2000.	R3

12. WEB RESOURCES

Sl. No	Topic	Web link
1.	Simple Stresses and Strains	https://onlinecourses.nptel.ac.in/noc22_ce75/preview
2.	Simple Bending	https://onlinecourses.nptel.ac.in/noc22_ce75/preview
3.	Deflection of Beams	hthttps://onlinecourses.nptel.ac.in/noc22_ce75/preview
4.	Spring and Torsion	https://youtu.be/tTBnW5gAieM
5.	Thin cylinder and sphere	https://youtu.be/YXgXw25E5RU

NPTEL/ OTHER UNIVERSITY video lectures related to syllabus:	
1.	https://www.youtube.com/watch?v=xMCReTC--Dg
2.	**https://www.youtube.com/watch?v=xMCReTC--Dg**
3.	https://www.youtube.com/watch?v=xMCReTC--Dg
4.	https://www.youtube.com/watch?v=xMCReTC--Dg

13. E- learning / NPTEL

14. MAGAZINE & JOURNALS

Magazine	1. https://asmedigitalcollection.asme.org/solid mechanics
Journals	1. https://jsm.arak.iau.ir/#:~:text=The%20Journal%20of%20Solid%20Mechanics,mechanics%20of%20solids%20and%20structures.

15. LESSON PLAN & 18. CONTENT DELIVERY METHODOLOGIES

S.NO	Unit	Topic to be covered	Hours needed	Mode of teaching (BB/PPT/Others)	Text/ Ref. Book
1.	I	Rigid bodies and deformable solids	1	BB	TI
2.		Tension, Compression	1	BB/ PPT	T1
3.		Shear Stresses	1	BB	T1
4.		Deformation of simple and compound bars	1	BB	T2
5.		Thermal stresses	1	BB	T2
6.		Elastic constants	1	BB	T2
7.	II	Beams	1	BB/ PPT	T1
8.		Type transverse loading on beams	1	BB/ PPT	T1
9.		Shear force in beams	1	BB	T1
10.		Bending moment in beams	1	BB	T1
11.		Cantilevers	1	BB/ PPT	T1
12.		Simply supported beams	1	BB/ PPT	T1
13.	III	Torsion formulation stresses and deformation in circular Shafts	2	BB	T2
14.		Torsion formulation stresses and deformation in hollows shafts	2	BB	T2
15.		Stresses in helical springs	1	BB/ PPT	T2
16.		Deflection of helical springs	1	BB	T2
17.	IV	Double Integration method	2	BB	T1
18.		Introduction of Area moments theorem	1	BB	T2
19.		For computational of slopes	2	BB	T2
20.		For computational of deflection beam	1	BB	T2
21.	V	Stresses in thin cylindrical shell due to internal pressure circumferential	2	BB	T2
22.		Longitudinal stresses	1	BB	T2

23.		Deformation in thin cylinders	1	BB	**T2**
24.		spherical shells subjected to internal pressure	1	BB	**T2**
25.		Deformation in spherical shells	1	BB	**T2**
26.		1. Tension test on a mild steel rod	3	EX	
27.		2. Compression test on wooden piece	3	EX	
28.		3. Torsion test on mild steel rod	3	EX	
29.		4. Deflection test on beams	3	EX	
30.		5. Compression test on helical springs	3	EX	

[+]**BB** - Blackboard, **EX** - Experimental, **PPT**- Power Point Presentation

19. ASSIGNMENTS

Assignment No.	Description	Submission due
1	Evaluate: Stress, Strain, and Deformation of solids related problems.	I week of September
2	Evaluate: Maximum bending moment and Compressive strength related problems.	III week of September
3	Evaluate: Deflection of helical springs and deformation in circular and hollows shafts related problems.	I week of October
4	Evaluate : Double integration method for cantilever beam	III week of October
5	Understand: Spherical shell and Cylindrical shell.	I week of November

20. ASSIGNMENT RUBRICS

Quality	Marks
Submission on Date	2
Understanding	3
Solving Skills/Presentation	3
End results with correct units' conversions / Conclusion	2

21. MAPPING COs with ASSIGNMENTS

CO's	CO - STATEMENTS	A1	A2	A3	A4	A5
CO1	Make use of fundamental concepts to determine stress and strain in structural members	3				
CO2	Construct the shear force and bending moment diagram for diverse beams under various loading condition and apply various methods to solve torsion on the body		3			
CO3	Apply various methods to solve problems in springs			3		
CO4	Utilize various methods to determine the deflection in beams and buckling of columns				3	
CO5	Evaluate the stress on columns & thin cylinders and know the application of theories of failure problems.					3

22. ASSESSMENT METHODOLOGIES

Assessment Tool		Description
CONTINIOUS ASSESSMENT	**40%**	CAT – I& CAT – II(From Theory portion-15 marks), CAT –III (From Practical component-5marks)will be considered for 20 marks, class test-5marks, MCQ 10 marks, Observation-5 marks Total 40marks
End semester Examination	**60%**	End semester Examination for 100 marks Converted to 60marks
Course End Survey		At the end of the Course, will be evaluated

23. DISTRIBUTION OF PORTIONS FOR ASSESSMENT TESTS

Assessments		Portion	% of weight age
CONTINIOUS ASSESSMENT	CAT – I	Unit-I , Unit-II ,50% unit III	37.5
	CAT – II	50%Unit-III, Unit – IV, Unit-V	
	CAT-III	Practical	12.5
	Class test(5)	Unit – I to Unit - V	12.5
	Observation	All Experiments	12.5
	MCQ	Unit – I to Unit - V	25
End Semester		Unit - 1 to 5	100

24. MARK ALLOTMENT FOR CO ASSESSMENT

COs	CAT – I (Theory)	CAT – II(Theory)	CAT-III(Practical)	Observation	Class test	MCQ	End Semester
CO1	20		100	10	26	6	100
CO2	20			10	26	6	
CO3	10	10		10	26	6	
CO4		20		10	26	6	
CO5		20		10	26	6	
Marks Converted to	15(5*3)		5	5	5	10	60

26. CONTENT BEYOND SYLLABUS

UNIT	TOPICS TO BE COVERED	Hrs Taken

I	Application of stresses induced in compound ties or struts	1
II	Bending stresses in beams	1
III	Application of springs in life to life scenario.	1
IV	Propped cantilever and beams	1
V	Thin and Thick Shells.	1

Course-Coordinator **HOD**