



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	MECHANICS OF SOLIDS LABORATORY				
Course Code	AAEB06				
Programme	B.Tech				
Semester	III	AE			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	-	3	2	1
Chief Coordinator	Ms. Ch Ragha Leena, Assistant Professor				
Course Faculty	Ms. Ch Ragha Leena, Assistant Professor Mr. R Suresh Kumar, Assistant Professor				

I. COURSE OVERVIEW:

The aim of this course is to study aerospace material mechanical properties such as tensile strength, modulus of rigidity, hardness, impact strength and compressive strength through experimentation. Experimental results are verified analytically.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AMEB03	II	Engineering Mechanics	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Mechanics of Solids Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Marker & Talk	✗	Quiz	✗	Assignments	✗	MOOCs
✓	LCD / PPT	✗	Seminars	✗	Mini Project	✗	Videos
✓	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	Laboratory		Total Marks
	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	Performance	Calculations and Graph	Results and Error Analysis	Viva	Total
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Presentation of real world problems
PO 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.	2	Calculations of the observations
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	1	Lab Practices
PO 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.	1	Term observations

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	Professional skills: Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	1	Lab Practices
PSO 2	Problem-solving Skills: Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles.	--	--
PSO 3	Practical implementation and testing skills: Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	--	--

PSO 4	Successful career and entrepreneurship: To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of Aeronautical/aerospace allied systems to become technocrats.	--	--
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3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand basic knowledge on the mechanical behavior of materials like aluminum, mild steel, and cast iron.
II	Adopt with the experimental methods to determine the mechanical properties of materials.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AAEBO6.01	CLO 1	Able to understand Brinell number of copper, mild steel, aluminum and brass materials.	PO 1	2
AAEBO6.02	CLO 2	Able to understand the hardness number of copper, mild steel, aluminum and brass materials.	PO 1	2
AAEBO6.03	CLO 3	Calculate the ultimate tensile strength, percentage of elongation, percentage of reduction of area of mild steel by using UTM.	PO 1, PO 2, PO 3, PO 4	2
AAEBO6.04	CLO 4	Able to draw stress strain diagram of mild steel.	PO 1, PO 2	1
AAEBO6.05	CLO 5	Calculate the modulus of rigidity of a given specimen by using torsion testing machine.	PO 1, PO 2, PO 3	2
AAEBO6.06	CLO 6	Able to draw the relation between T- θ diagram	PO 1, PO 2, PO 3	1
AAEBO6.07	CLO 7	Understand torsion equation of circular shaft which is fixed at one end and free at other end.	PO 1, PO 2, PO 3	2
AAEBO6.08	CLO 8	Calculate impact strength of a given specimen by Izod impact test	PO 2, PO 3	1
AAEBO6.09	CLO 9	Calculate impact strength of a given specimen by Charpy impact test	PO 1, PO 3	1
AAEBO6.10	CLO 10	Calculate compressive strength of a given specimen by using compression testing machine.	PO 1, PO 3	2
AAEBO6.11	CLO 11	Calculate Young's modulus of the long column by using UTM.	PO 1, PO 2, PO 3	2
AAEBO6.12	CLO 12	Able to understand the behavior of spring under gradually applied load.	PO 1, PO 3	2

AAEBO6.13	CLO 13	Study the variation of stress along the cross section of the simply supported beam under uniformly distributed load.	PO 1,PO 2, PO 3, PO 4	3
AAEBO6.14	CLO 14	Study the variation of stress along the cross section of the cantilever beam under uniformly distributed load.	PO 1,PO 2, PO 3, PO 4	3

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X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 1	2															
CLO 2	2															
CLO 3	2	2	1	1												
CLO 4	1	1											1			
CLO 5	2	1	2													
CLO 6	1	1	1													
CLO 7	2	1	2										1			
CLO 8		1	1													
CLO 9	1		1													
CLO 10	2		2													
CLO 11	2	1	2													
CLO 12	2		2													
CLO 13	3	3	2	2									1			
CLO 14	3	3	2	2									1			

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2 PO 3, PO 4	SEE Exams	PO 1, PO 2 PO 3, PO 4	Assignments	-	Seminars	-
Laboratory Practices	PO 1, PO 2 PO 3, PO 4	Student Viva	-	Mini Project	-	Certification	-

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

LIST OF EXPERIMENTS	
Week-1	BRINELL HARDNESS TEST
Determination of Brinell number of a given test specimen.	
Week-2	ROCKWELL HARDNESS TEST
Determination of hardness number of different specimens such as steel, brass, copper and aluminum.	
Week-3	TENSION TEST
Study the behavior of mild steel and various materials under different loads. To determine a) Tensile b) Yield strength c) Elongation d) Young's modulus	
Week-4	TORSION TEST
Determine of Modulus of rigidity of various specimens.	
Week-5	IZOD IMPACT TEST
Determination the toughness of the materials like steel, copper, brass and other alloys using Izod test	
Week-6	CHARPY IMPACT TEST
Determine the toughness of the materials like steel, copper, brass and other alloys using Charpy test.	
Week-7	COMPRESSION TEST ON SHORT COLUMN
Determine the compressive stress on material.	
Week-8	COMPRESSION TEST ON LONG COLUMN
Determine Young's modulus of the given long column.	
Week-9	TESTING OF SPRINGS
Determine the stiffness of the spring and the Modulus of rigidity of wire material.	
Week-10	DEFLECTION TEST FOR SSB AND CANTILEVER BEAM
Determine the Young's modulus of the given material with the help of deflection of SSB and cantilever beam.	
Week-11	REVIEW - I
Spare session for additional repetitions and review.	
Week-12	REVIEW - II
Spare session for additional repetitions and review.	

Reference Books:

1. Gere, Timoshenko, "Mechanics of Materials", McGraw Hill, 3rd Edition, 1993.
2. R. S Kurmi, Gupta, "Strength of Materials", S. Chand, 24th Edition, 2005.
3. William Nash, "Strength of Materials", Tata McGraw Hill, 4th Edition, 2004.

XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Week No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Determination of Brinell number of a given test specimen.	CLO 1	R1: 1.2
2	Determination of hardness number of different specimens such as steel, brass, copper and aluminum.	CLO 2	R2: 3.5
3	Study the behavior of mild steel and various materials under different loads. To determine a) Tensile b) Yield strength c) Elongation d) Young's modulus	CLO 3, CLO 4	R1: 3.4
4	Determine of Modulus of rigidity of various specimens.	CLO 5	R1: 2.2
5	Determination the toughness of the materials like steel, copper, brass and other alloys using Izod test	CLO 8	R1: 2.4
6	Determine the toughness of the materials like steel, copper, brass and other alloys using Charpy test.	CLO 9	R3: 4.5
7	Determine the compressive stress on material.	CLO 10, CLO 11	R2: 2.6
8	Determine Young's modulus of the given long column.	CLO 10, CLO 11	R2: 2.6
9	Determine the stiffness of the spring and the Modulus of rigidity of wire material.	CLO 13, CLO 14	R1: 5.2
10	Determine the Young's modulus of the given material with the help of deflection of SSB and cantilever beam.	CLO 13, CLO 14	R1: 5.2
11	Spare session for additional repetitions and review.	CLO 13, CLO 14	R1:7.2
12	Spare session for additional repetitions and review.	CLO 18	R1:7.3

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Interpretation of results by testing various materials	Guest Lectures	PO 1, PO 2, PO 4	PSO 1, PSO 3 PSO 4
2	Encourage students to design and analyze beams using ANSYS	NPTEL	PO 2, PO 3	PSO 1, PSO 3, PSO 4

Prepared by:

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HOD, AE