INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**AEROSPACE STRUCTURES LABORATORY**				
Course Code	AAE104				
Programme	B.Tech				
Semester	IV	AE			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Dr. Y B Sudhir Sastry, Professor				
Course Faculty	Dr. Y B Sudhir Sastry, Professor Ms. M.Mary Thraza ,Assistant Professor				

I. COURSE OVERVIEW:

The aim of this course is to conduct experiments on basic principles of structures and it is further extended to cover the application of aerospace structures in industrial applications The aim is to understand concepts and developments in the aerospace structures, and improve your understanding of a range of specialized subjects practically and global best practices. Learn how structural tests are important with current regulatory. The course deals with the different structures, like beams columns etc., . This course includes experiments deal with the study of structures

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHS007	I	Applied Physics	4
UG	AME002	II	Engineering Mechanics	4
UG	AAE101	III	Mechanics of solids	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Aerospace Structures Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & 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**
Type of Assessment	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.	3	Calculations of the observations
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	Characteristic curves
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.	2	videos
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.	2	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	2	Guest lectures
PSO2	**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.	2	videos
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	1	Presentation on real-world problems
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.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Provide basic knowledge on the mechanical behavior of materials like aluminum, mild steel, and cast iron
II	Visualize the crack detection using various NDT methods and also discuss the changing strength due to these defects.
III	Understand the concept of locating the shear centre for open and closed section of beams.
IV	Obtain buckling strength of both long and short columns using different elastic supports.

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
AAE 104.01	CLO 1	Understand the various engineering materials property subjected to tensile loads.	PO 1	3
AAE104.02	CLO 2	Understand the stress strain curves of various engineering materials subjected to tensile loads.	PO 1, PO 3	3
AAE104.03	CLO 3	Understand the Stress and deflections of beams subjected to transverse loads for various end conditions	PO 1, PO 3	3
AAE104.04	CLO 4	Understand the Stress and deflections of beams subjected to transverse loads for various end conditions	PO 1, PO 2, PO 4	2
AAE104.05	CLO 5	verification of Maxwell's reciprocal theorem by using Beam test rig	PO 1, PO 3	2
AAE104.06	CLO 6	Understanding the critical buckling loads of long columns subjected to Compression loads	PO 1, PO 2, PO 4	2
AAE104.07	CLO 7	Understanding the critical buckling loads of short columns subjected to Compression loads	PO 1, PO 2, PO 3	1
AAE104.08	CLO 8	Verification of south well plot columns subjected to loads,	PO 1, PO 2, PO 3	1
AAE104.09	CLO 9	Understanding the Unsymmetrical Bending behavior of a Beam.	PO 1, PO 2	2
AAE104.10	CLO 10	Understanding the Shear Centre behavior of an open Section beam	PO 1, PO 3	2
AAE104.11	CLO 11	Understanding the Shear Centre behavior of an closed Section beam	PO 1, PO 3	3
AAE104.12	CLO 12	Understanding the Wagner beam concept for Tension field beam	PO 1, PO 2	3
AAE104.13	CLO 13	Understanding Fabrication and determine the young's modulus of a sandwich structures	PO 1, PO 3	3
AAE104.14	CLO 14	The Study of non-destructive testing procedures using dye penetration.	PO 1, PO 2	2
AAE104.15	CLO 15	Understanding the Magnetic particle inspection and ultrasonic techniques.	PO 1, PO 3, PO 4	2
AAE104.16	CLO 16	Determination of natural frequency of beams under free and forced vibration	PO 1, PO 2, PO 3, PO 4	2

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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	3												1	2		
CLO 2	3		3										1		1	
CLO 3	3		3										1	2		
CLO 4	2	2		2									1	2	1	
CLO 5	2		2										1	2	1	
CLO 6	2	2		2										2		
CLO 7	1	1	1										1			
CLO 8	1	1	1											2		
CLO 9	2	2												2	1	
CLO 10	2		2										1			
CLO 11	3		3											2		
CLO 12	3	3											1			
CLO 13	3		3										1	2		
CLO 14	2	2											1		1	
CLO 15	2		2	2									1	2		
CLO 16	2	2	2	2									1		1	

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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	**DIRECT TENSION TEST**
Tensile testing using UTM, mechanical and optical extensometers, stress strain curves and strength test or various engineering materials.	
Week-2	**DEFLECTION TEST**
Stress and deflections of beams for various end conditions, verification of Maxwell's theorem	
Week-3	**BUCKLING TEST)**
Compression tests on long columns, Critical buckling loads.	
Week-4	**BUCKLING TEST**
Compression tests on short columns, Critical buckling loads, south well plot.	
Week-5	**BENDING TEST**
Unsymmetrical Bending of a Beam..	
Week-6	**SHEAR CENTRE FOR OPEN SECTION**
Shear Centre of an open Section beam.	
Week-7	**SHEAR CENTRE FOR CLOSED SECTION**
Shear Centre of a closed Section beam.	
Week-8	**WAGNER'S THEOREM**
Wagner beam – Tension field beam	
Week-9	**SANDWICH PANEL TENSION TEST**
Fabrication and determine the young's modulus of a sandwich structures	
Week-10	**NON-DESTRUCTIVE TESTING**
Study of non-destructive testing procedures using dye penetration,	
WeeK-11	**NON-DESTRUCTIVE TESTING**
Magnetic particle inspection and ultrasonic techniques.	
Week-12	**VIBRATION TEST**
Determination of natural frequency of beams under free and forced vibration using.	
Text Books:	
1 R. K Bansal, ―Strength of Materials‖, Laxmi publications, 5th Edition, 2012. 2 T. H. G. Megson, ―Aircraft Structures for Engineering Students‖, Butterworth-Heinemann Ltd, 5th Edition, 2012 Gere, Timoshenko, ―Mechanics of Materials‖, McGraw Hill, 3rd Edition, 1993	
Reference Books:	
1. Dym, C. L, Shames, I. H, ―Solid Mechanics‖, McGraw Hill, Kogakusha, Tokyo, 7th Edition, 2007. 2. Stephen Timoshenko, ―Strength of Materials‖, Vol I & II, CBS Publishers and Distributors, 3rd Edition, 2004. 3. R. K. Rajput, ―Strength of Materials‖, S. Chand and Co., 1st Edition, 1999. 4. Timoshenko, S, Young, D. H. ―Elements of Strength of Materials‖, T. Van Nostrand Co. Inc., Princeton N.J, 4th Edition, 1977.	

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 stress strain curves and strength test or various engineering materials by using tensile testing using	CLO 1, CLO 2, CLO 3	T1:1.8
2	verification of Maxwell's theorem by finding Stress and deflections of beams for various end conditions	CLO 1, CLO 2, CLO 3, CLO 6	T1:2.5
3	Determination of Critical buckling loads by Compression tests on long columns	CLO 5, CLO 6, CLO 7	T1:2.9
4	Determination of Critical buckling loads, south well plot by Compression tests on short columns.	CLO 4, CLO 7	T1:3.2
5	Determine unsymmetrical Bending of a Beam	CLO 8, CLO 9	T1:3.7
6	Determination of Shear Centre of an open Section beam	CLO 9, CLO 10	T1:5.3
7	Determination of Shear Centre of a closed Section beam.	CLO , CLO 10	T1:4.5
8	Wagner beam – Tension field beam.	CLO 7, CLO 10	T2:3.5 R1:6.8
9	Fabrication and determine the young's modulus of a sandwich structures.	CLO 11, CLO 12	T2:7.4 R1:7.1
10	Study of non-destructive testing procedures using dye penetration	CLO 12, CLO 10	T1:12.3 R2:3.2
11	Magnetic particle inspection and ultrasonic techniques.	CLO 13, CLO 14,	T3:12.10 R1:13.7
12	Determination of natural frequency of beams under free and forced vibration using.	CLO 13, CLO 15, CLO 16,	T3:11.2 R1:10.2

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

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	To improve standards and analyze the concepts.	Guest Lectures	PO 1, PO 4	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 2	PSO 1

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