INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**AEROSPACE STRUCTURAL DYNAMICS LABORATORY**				
Course Code	AAE113				
Programme	B.Tech				
Semester	VII	AE			
Course Type	Laboratory				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Mr. T. Mahesh Kumar, Assistant Professor				
Course Faculty	Dr. Y B Sudhir Sastry, Professor Mr. T. Mahesh Kumar, Assistant Professor				

I. COURSE OVERVIEW:

This course focuses on mechanical devices that are designed to have mobility to perform certain functions. In this process they are subjected to some forces. This course will provide the knowledge on how to analyze the motions of mechanisms and design mechanisms to give required strength. This includes relative static and dynamic force analysis and consideration of gyroscopic effects on aero planes, ships, automobiles like two wheelers and four wheelers. Balancing of rotating and reciprocating masses, friction effect in brakes clutches and dynamometers are also studied. Mechanical vibrations give an insight into the various disturbances while designing vibratory systems.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHS007	I	Applied physics	4
UG	AME002	II	Engineering Mechanics	4
UG	AAE002	III	Theory of Structures	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Aerospace Structural Dynamics 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	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.	-	-

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 aerospace and allied systems and become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand the basic principles of kinematics and the related terminology of machines.
II	Discriminate mobility; enumerate links and joints in the mechanisms.
III	Formulate the concept of analysis of different mechanisms

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
AAE015.01	CLO 1	Understand basic units of measurement, convert units, and appreciate their magnitudes.	PO 1	3
AAE015.02	CLO 2	Utilize basic measurement techniques of theory of machines.	PO 1, PO 3	3
AAE015.03	CLO 3	Perform kinematic analysis of mechanisms	PO 1, PO 3	3
AAE015.04	CLO 4	Perform dynamic analysis of mechanisms	PO 1, PO 2	3
AAE015.05	CLO 5	Calculate position, velocity, and acceleration of linkages	PO 1, PO 3	3
AAE015.06	CLO 6	Calculate speed ratio of gear trains	PO 1, PO 2	3
AAE015.07	CLO 7	Identify mechanisms in real life applications	PO 1, PO 2, PO 3	2
AAE015.08	CLO 8	Perform kinematic analysis of simple mechanisms.	PO 1, PO 2, PO 3	2
AAE015.09	CLO 9	Perform static and dynamic force analysis of slider crank mechanism	PO 1, PO 2	3
AAE015.10	CLO 10	Determine moment of inertia of rigid bodies experimentally	PO 1, PO 3	3
AAE015.11	CLO 11	Determine the Gyroscope couple	PO 1, PO 3	3
AAE015.12	CLO 12	Determine the bearing life of Ball bearing	PO 1, PO 2	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	3												1			
CLO 2	3		3										1			
CLO 3	3		3										1			
CLO 4	2	2											1			
CLO 5	2		2										1			
CLO 6	2	2														
CLO 7	1	1	1										1			
CLO 8	1	1	1													
CLO 9	2	2														
CLO 10	2		2										1			
CLO 11	3		3													
CLO 12	3	3											1			

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XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2 PO 3,	SEE Exams	PO 1, PO 2 PO 3,	Assignments	-	Seminars	-
Laboratory Practices	PO 3, PSO 1	Student Viva	PO 1, PO 2	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	**GOVERNORS**
To study the function of a Governor	
Week-2	**GYROSCOPE**
To determine the Gyroscope couple.	
Week-3	**STATIC FORCE ANALYSIS**
To draw free body diagram and determine forces under static condition.	
Week-4	**DYNAMIC FORCE ANALYSIS**
To draw free body diagram and determine forces under dynamic condition.	
Week-5	**BALANCING**
To determine balancing forces and reciprocating masses.	
Week-6	**BEARINGS**
To determine the bearing life.	
Week-7	**VIBRATIONS**
To determine the longitudinal and transfer vibration.	
Week-8	**WHIRLING**
To determine critical speed of a shaft.	
Week-9	**MECHANISMS**
To design various mechanism and their inversions	
Week-10	**DIFFERENTIAL GEAR BOX**
To study automobile differential gear box.	
WeeK-11	**INDEXING**
To study various intermittent mechanism.	
Week-12	**EXAMINATIONS**

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1-3	To study the function of a Governor	CLO 1, CLO 2, CLO 3, CLO 6	T1:1.4 R1:1.2
4-6	To determine the Gyroscope couple.	CLO 1, CLO 2, CLO 11, CLO 6	T1:1.5 R1:2.4

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
7-9	To draw free body diagram and determine forces under static condition.	CLO 5, CLO 6, CLO 12	T1:2.5 R1:2.5
10-12	To draw free body diagram and determine forces under dynamic condition.	CLO 4, CLO 6	T1:2.5 R1:2.6
13-15	To determine balancing forces and reciprocating masses.	CLO 12, CLO 6	T1:22.7
16-18	To determine the bearing life.	CLO 7, CLO 10	T1:6.3 R1:5.3
19-21	To determine the longitudinal and transfer vibration.	CLO 7, CLO 10	T1:7.5 R1:6.3
22-24	To determine critical speed of a shaft.	CLO 7, CLO 10	T1:8.5 R1:6.8
25-27	To design various mechanism and their inversions	CLO 8, CLO 9	T1:12.2 R1:13.1
28-30	To study automobile differential gear box.	CLO 8, CLO 9	T1:12.3 R1:13.2
31-33	To study various intermittent mechanism.	CLO 8, CLO 9	T1:12.10 R1:13.7

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.	Case Studies	PO 1, PO 4	PSO 1
2	Conditional probability, Sampling distribution, correlation, regression analysis and testing of hypothesis	NPTEL	PO 4, PO3	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	Internships	PO 2	PSO 1

Prepared by: **HOD, AE**

Mr. T. Mahesh Kumar, Assistant Professor

Dr. Y B Sudhir Sastry, Professor