INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	APPLIED PHYSICS				
Course Code	AHS007				
Programme	B.Tech				
Semester	I	AE | ME | CE			
Course Type	Foundation				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	Dr. Rizwana, Professor				
Course Faculty	Mr. K Saibaba, Assistant Professor				

I. COURSE OVERVIEW:

The course matter is divided into five units covering duly-recognized areas of theory and study. This course develops abstract and critical reasoning by studying mathematical and logical proofs and assumptions as applied in basic physics and to make connections between physics and other branches of sciences and technology. The topics covered include dielectric and magnetic properties, acoustics of buildings, ultrasonic and equilibrium of system of forces, friction and dynamics of rigid bodies. The course helps students to gain knowledge of basic principles and appreciate the diverse applications in technological fields in respective branches and also in their lives.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Basic principles of Physics

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Applied Physics	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:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into Five units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

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

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Theory**		**Total Marks**
Type of Assessment	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz / Alternative Assessment Tool (AAT):

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

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 on 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	Seminar
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 Paper

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	Seminar
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	Develop the strong fundamentals of system of forces and friction.
II	Strengthen the knowledge of theoretical and technological aspects of dynamics of rigid bodies.
III	Correlate principles with applications of the dielectric and magnetic materials.
IV	Enrich knowledge in acoustics and ultrasonic.

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
AHS007.01	CLO 1	Recall the basic principles of physics.	PO 1 , PO 2	3
AHS007.02	CLO 2	Apply the concepts and principles in solving the problems of physics.	PO 1 , PO 4	2
AHS007.03	CLO 3	Acquire knowledge of basic terms related to dielectric materials and different polarization mechanisms.	PO 1 , PO 4	2
AHS007.04	CLO 4	Review properties of different magnetic materials and magnetization based on orientation of domains.	PO 1 , PO 2	2
AHS007.05	CLO 5	Recollect basic principles of acoustics of buildings and modern architectural acoustic techniques.	PO 1 , PO 2	2
AHS007.06	CLO 6	Explain production, properties and applications of ultrasonic waves	PO 1 , PO 2	2
AHS007.07	CLO 7	Review the basic concepts of system of forces.	PO 1 , PO 4	1
AHS007.08	CLO 8	Analyze different law of forces and condition of equilibrium.	PO 2 , PO 4	1
AHS007.09	CLO 9	Discuss different types and laws of friction.	PO 2 , PO 4	1
AHS007.10	CLO 10	Interpret applications of friction.	PO 1 , PO 2	2
AHS007.11	CLO 11	Describe rotational motion of rigid bodies and moment of inertia of some of the regular shapes.	PO 1 , PO 4	2
AHS007.12	CLO 12	Identify and apply theorems of moment of inertia.	PO 1 , PO 2	3
AHS007.13	CLO 13	Correlate different concept of physics with day to day life applications.	PO 1	2
AHS007.14	CLO 14	Understand the technical importance of moment of inertia of regular and irregular bodies.	PO 2	2
AHS007.15	CLO 15	Identify the modern engineering devices based on basic principles of forces and friction.	PO 4	1

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC 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	2											2			
CLO 2	2			2									1			
CLO 3	3			1									2			
CLO 4	1	3														
CLO 5	3	2														
CLO 6	2	2											2			
CLO 7	2			1									2			

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 8		2		1												
CLO 9		1		1									2			
CLO 10	3	2											1			
CLO 11	2			1												
CLO 12	3	2											2			
CLO 13	2															
CLO 14		2											1			
CLO 15				1												

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1,PO2	SEE Exams	PO1,PO4	Assignments	PO4	Seminars	PO2
Laboratory Practices	PO1,PO2	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO 4						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Unit-I	DIELECTRIC AND MAGNETIC PROPERTIES
Dielectric Properties: Basic definitions, electronic, ionic and orientation polarizations-qualitative; Internal field in solids. Magnetic Properties: Basic definitions, origin of magnetic moment, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, domain theory of ferro magnetism on the basis of hysteresis curve.	
Unit-II	ACOUSTICS AND ULTRASONICS
Acoustics: Reverberation, reverberation time, Sabine's formula (qualitative), absorption coefficient, measurement of absorption coefficient, factors affecting acoustics of an auditorium and their remedies; Ultrasonics: Introduction; Generation of ultrasonic waves; Magnetostriction method, piezoelectric method, properties, applications.	
Unit-III	**EQUILIBRIUM OF SYSTEM OF FORCES**
Introduction, basic concepts, system of forces, coplanar concurrent forces, force systems in plane, parallel forces in plane; Force systems in space, couples, resultant, Lami's theorem, triangle law of forces, polygon law of forces, condition of equilibrium.	

Unit-IV	FRICTION
Friction: Types of friction, limiting friction, laws of friction, angle of repose, equilibrium of body laying on rough inclined plane, Application of friction: ladder friction, wedge friction, screw friction.	
Unit-V	**DYNAMICS OF RIGID BODIES - MOMENT OF INERTIA**
Rotational motion, torque, angular momentum, relation between torque and angular momentum, angular momentum of system of particles, moment of inertia, expression for moment of inertia, radius of gyration, theorems on moment of inertia, moment of inertia of thin rod, rectangular lamina, circular disc.	

Text Books:

1. Dr. K. Vijaya Kumar, Dr. S. Chandralingam, "Modern Engineering Physics", Chand & Co. New Delhi, 1st Edition, 2010.
2. R. C Hibbler, "Engineering mechanics", Prentice Hall, 12th Edition, 2009.

Reference Books:

1. R. K. Gaur, S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Edition, 2001.
2. Timoshenko, D. H. Young, "Engineering mechanics", Tata Mc Graw Hill, 5th Edition, 2013.
3. Hitendra K Malik, A. K. Singh, "Engineering Physics", Mc Graw Hill Education, 1stEdition,2009.
4. S. S. Bhavikatti, "A text book of Engineering mechanics", New age international, 1st Edition, 2012.

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	Acquire knowledge of basic terms related to dielectric materials.	CLO 1	T1:13.5 R1:1.3
2	Discuss different polarization mechanisms in dielectrics	CLO 2	T1:13.5 R1:1.3
3-4	Derive expression for total electric field at a given point inside dielectrics.	CLO 32	T1:13.5 R1:1.3
5	Acquire knowledge of basic terms related to magnetic materials.	CLO 3	T1:14.7 R1:3.4
6	Describe magnetic moment in an atom in terms of Bohr Magneton	CLO 3	T1:15.7 R1:4.10
7-8	Classify different magnetic materials based on electron theory.	CLO 4	T1:16.8 R1:4.15
9	Examine the spontaneous magnetization in ferromagnets based on orientation of domains	CLO 4	T1:16.9 R1:5.4
10	Explain the basic terms related to acoustics of buildings	CLO 5	T1:17.9 R1:5.8
11	Analyze the Sabine's formula of reverberation time	CLO 5	T1:18.10 R1:6.8
12	Calculate the absorption coefficient of a surface	CLO 6	T1:19.10 R1:6.13
13	Identify remedies for factors affecting architectural acoustics	CLO 6	T1:19.9 R1:7.5
14-15	Recall basics of ultrasonics	CLO 5	T1:23.10 R1:7.5
16	Explain the production of ultrasonics by Magnetostriction method	CLO 6	T1:23.10 R1:8.1
17	Explain the production of ultrasonics by Piezoelectric method	CLO 6	T1:23.1 R1:9.2
18-19	Review the properties of ultrasonics	CLO 6	T1:23.1 R1:9.4

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
20	Discuss the applications of ultrasonics	CLO 6	T1:23.1 R1:9.9
21	Identify the principle of forces	CLO 7	T1:23.1 R1:9.10
22	Recall different system of forces	CLO 7	T2:27.5 R1:10.2
23	Acquire knowledge of force systems in space	CLO 7	T2:27.7 R1:11.3
24-25	Analyze parallel forces in plane	CLO 8	T2:27.8 R1:11.6
26	Correlate couples in systems	CLO 8	T2:27.12 R1:11.7
27-28	Apply Lami's theorem to problems	CLO 8	T2:27.12 R1:11.8
29	Analyze triangle law of forces	CLO 8	T2:27.12 R1:11.9
30	Analyze polygon law of forces	CLO 7	T2:27.12 R1:11.10
31-32	Recognize condition of equilibrium	CLO 9	T2:27.14 R1:12.3
33	Understand friction	CLO 9	T2:27.1 R1:12.7
34-35	Discuss limiting friction	CLO 9	T2:27.17 R1:12.15
36	Analyze laws of friction	CLO 10	T2:27.18 R1:12.19
37-38	Describe angle of repose	CLO 10	T2:27.19 R2:14.4
39	Identify equilibrium of body laying on rough inclined plane	CLO 10	T2:27.20 R2:14.5
40-41	Solve problems on friction	CLO 10	T2:30.19 R2:14.5
42-43	Understand ladder friction	CLO 10	T2:30.20 R2:15.5
44-45	Discuss wedge friction	CLO 10	T2:32.19 R2:16.5
46-47	Describe screw friction	CLO 10	T2:32.20 R2:16.5
48-49	Explain basic concept rotational motion	CLO 11	T2:33.1 R2:16.6
50-51	Derive relation between torque and angular momentum	CLO 11	T2:34.1 R2:17.1
52-53	Acquire the knowledge of moment of inertia	CLO 12	T2:35.2 R2:17.2
54-55	Examine radius of gyration	CLO 11	T2:36.1 R2:18.1
56-57	Understand theorems on moment of inertia	CLO 12	T2:38.19 R2:16.5
58-59	Calculate moment of inertia of thin rod, Rectangular lamina	CLO 12	T2:39.19 R2:16.5
60	Calculate moment of inertia of circular disc	CLO 12	T2:40.19 R2:16.5

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.	Seminars	PO 1	PSO 1
2	Conditional probability, Sampling distribution, correlation, regression analysis and testing of hypothesis	Seminars / NPTEL	PO 4	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	Guest lecture	PO 2	PSO 1

Prepared by:
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