INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTION

Course Title	**APPLIED PHYSICS** (Common for AE / ME/ CE)			
Course Code	**AHS008**			
Course Structure	**Lectures**	**Tutorials**	**Practicals**	**Credits**
	3	1	-	4
Course Coordinator	Dr. A Jayanth Kumar, Professor			
Team of Instructors	Dr. A Jayanth Kumar, Dr. Rizwana, Dr. N Rajeshwar Rao, Ms. S Charvani, Ms. K Sowmya, Mr. K Sai Baba, Mr. V S K Prasad			

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, ultrasonics, 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. PREREQUISITE(S)

Level	Credits	Periods	Prerequisite
UG	4	3	The basics of analytical and conceptual understanding of physics

III. MARKS DISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Applied Physics	70 Marks	30 Marks	100 Marks

Semester End Examination 70 Marks All the Units (1, 2, 3, 4 and 5)	70 Marks (3 Hours)	5 questions to be answered. Each question carries 14 Marks

<table>
<tr><td rowspan="6">Average of two CIA Examinations</td><td colspan="4">Continuous Internal Assessment - 1</td></tr>
<tr><td rowspan="2">30 Marks
(2 Hours)</td><td rowspan="2">Units
I, II and
III (half)</td><td rowspan="2">Continuous Internal Examination (CIE)
(2 hours)</td><td>Part - A
5 questions to be answered out of 5 questions, each carries 1 mark.</td></tr>
<tr><td>Part - B
4 questions to be answered out of 5 questions, each carries 5 marks.</td></tr>
<tr><td>Quiz-I /Alternate Assessment Tool
(AAT- I)</td><td>5 marks for assignment.</td></tr>
<tr><td colspan="4">Continuous Internal Assessment - 2</td></tr>
<tr><td rowspan="2">30 Marks
(2 Hours)</td><td rowspan="2">Units
III (half)
IV and V</td><td rowspan="2">Continuous Internal Examination (CIE)
(2 hours)</td><td>Part – A
5 questions to be answered out of 5 questions, each carries 1 mark.</td></tr>
<tr><td>Part - B
4 questions to be answered out of 5 questions, each carries 5 marks.</td></tr>
<tr><td>Quiz-II /Alternate Assessment Tool
(AAT- II)</td><td>5 marks for assignment.</td></tr>
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IV. EVALUATION SCHEME

S. No	Component	Duration	Marks
1	CIE - I Examination	2 hour	25
2	Quiz - I / AAT - I	-	05
TOTAL			30
3	CIE - II Examination	2 hour	25
4	Quiz - II / AAT - II	-	05
TOTAL			30
CIA Examination marks to be considered as average of above two CIA's			
5	EXTERNAL Examination	3 hours	70
GRAND TOTAL			100

V. COURSE OBJECTIVES

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 ultrasonics.

VI. COURSE OUTCOMES

After completing this course the student must demonstrate the knowledge and ability to:

1. **Recall** the basic principles of physics.
2. **Apply** the concepts and principles in solving the problems of physics.
3. **Acquire** knowledge of basic terms related to dielectric materials and different polarization mechanisms.
4. **Review** properties of different magnetic materials and magnetization based on orientation of domains.
5. **Recollect** basic principles of acoustics of buildings and modern architectural acoustic techniques.
6. **Explain** production, properties and applications of ultrasonic waves.
7. **Review** the basic concepts of system of forces.
8. **Analyze** different law of forces and condition of equilibrium.
9. **Discuss** different types and laws of friction.
10. **Interpre**t applications of friction.
11. **Describe** rotational motion of rigid bodies and moment of inertia of some of the regular shapes.
12. **Identify** and **apply** theorems of moment of inertia.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments
PO2	**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.	H	Assignments
PO3	**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.	S	Exercise
PO4	**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.	H	Exercise
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Exercise
PO6	**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.	S	Exercise
PO7	**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	S	Discussion, Seminar

	development.		
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	-----
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	S	Discussion
PO10	**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.	S	Discussion, Seminar
PO11	**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.	N	-----
PO12	**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.	H	Prototype, Discussion

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		**Level**	**Proficiency Assessed by**
PSO1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products.	S	Lectures and Assignments
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.	S	-----
PSO3	**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.	S	-----

N - None **S - Supportive** **H – Highly Related**

IX. 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.

Textbooks:

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.

Referencebooks:

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, 1st Edition, 2009.
4. S. S. Bhavikatti, "A text book of Engineering mechanics", New age international, 1st Edition, 2012.

X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Unit No.	Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
I	1	**Acquire** knowledge of basic terms related to dielectric materials.	Basic definitions of dielectric materials	T1, T2, R1, R2
	2	**Discuss** different polarization mechanisms in dielectrics	electronic, ionic and orientation polarizations	T1, T2, R1, R2
	3-4	**Derive** expression for total electric field at a given point inside dielectrics.	Internal field in solids	T1, T2, R1, R2
	5	**Acquire** knowledge of basic terms related to magnetic materials.	Basic definitions of magnetic materials	T1, T2, R1, R2
	6	**Describe** magnetic moment in an atom in terms of Bohr Magneton	origin of magnetic moment, Bohr magneton	T1, T2, R1, R2
	7-8	**Classify** different magnetic materials based on electron theory.	Classification of dia, para and ferro magnetic materials on the basis of magnetic moment	T1, T2, R1, R2
	9	**Examine** the spontaneous magnetization in ferromagnets based on orientation of domains	Domain theory of ferro magnetism on the basis of hysteresis curve	T1, T2, R1, R2
II	10	**Explain** the basic terms related to acoustics of buildings	Acoustics: Reverberation, reverberation time	T1, T2, R1, R2
	11	**Analyze** the Sabine's formula of reverberation time	Sabine's formula	T1, T2, R1, R2
	12	**Calculate** the absorption coefficient of a surface	Absorption coefficient, measurement of absorption coefficient	T1, T2, R1, R2
	13	**Identify** remedies for factors affecting architectural acoustics	Factors affecting acoustics of an auditorium and their remedies	T1, T2, R1, R2
	14	**Recall** basics of ultrasonics	Ultrasonics: Introduction	T1, T2, R1, R2
	15	**Explain** the production of ultrasonics by Magnetostriction method	Generation: Magnetostriction method	T1, T2, R1, R2
	16	**Explain** the production of ultrasonics by Piezoelectric method	Generation: Piezoelectric method	T1, T2, R1, R2
	17	**Review** the properties of ultrasonics	Properties of ultrasonic waves	T1, T2, R1, R2
	18	**Discuss** the applications of ultrasonics	Applications of ultrasonic waves	T1, T2, R1, R2
III	19	**Identify** the principle of forces	Introduction, basic concepts	T1, T2, R1, R4
	20	**Recall** different system of forces	System of forces, coplanar concurrent forces	T1, T2, R1, R4
	21	**Acquire** knowledge of force systems in space	Force systems in space	T1, T2, R1, R4
	22	**Analyze** parallel forces in plane	Parallel forces in plane	T1, T2, R1, R4

	23	**Correlate** couples in systems	Couples, resultant	T1, T2, R1, R4
	24	**Apply** Lami's theorem to problems	Lami's theorem	T1, T2, R1, R4
	25	**Analyze** triangle law of forces	Triangle law of forces	T1, T2, R1, R4
	26	**Analyze** polygon law of forces	Polygon law of forces	T1, T2, R1, R4
	27	**Recognize** condition of equilibrium	Condition of equilibrium	T1, T2, R1, R4
IV	28	**Understand** friction	Friction: Introduction, types of friction	T1, T2, R1, R2
	29	**Discuss** limiting friction	Limiting friction	T1, T2, R1, R2
	30	**Analyze** laws of friction	Laws of friction	T1, T2, R1, R2
	31	**Describe** angle of repose	Angle of repose	T1, T2, R1, R2
	32	**Identify** equilibrium of body laying on rough inclined plane	Equilibrium of body laying on rough inclined plane	T1, T2, R1, R2
	33	**Solve** problems on friction	Problems	T1, T2, R1, R2
	34	**Understand** ladder friction	Ladder friction	T1, T2, R1, R2
	35	**Discuss** wedge friction	Wedge friction	T1, T2, R1, R2
	36	**Describe** screw friction	Screw friction	T1, T2, R1, R2
V	37	**Explain** basic concept rotational motion	Rotational motion, torque, angular momentum	T1, T2, R1, R2
	38-39	**Derive** relation between torque and angular momentum	Relation between torque and angular momentum	T1, T2, R1, R2
	40-41	**Acquire** the knowledge of moment of inertia	Angular momentum of system of particles, moment of inertia, Expression for moment of inertia	T1, T2, R1, R2
	42	**Examine** radius of gyration	Radius of gyration	T1, T2, R1, R2
	43	**Understand** theorems on moment of inertia	Theorems on moment of inertia	T1, T2, R1, R2
	44	**Calculate** moment of inertia of thin rod, Rectangular lamina	Moment of inertia of thin rod, Rectangular lamina	T1, T2, R1, R2
	45	**Calculate** moment of inertia of circular disc	Circular disc.	T1, T2, R1, R2

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF THE PROGRAM OUTCOMES

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	H	H	S	H	S	H	S		S	S		H	S	S	S
II	H	H	S	H	S	S	S		S	S		H	S	S	S
III	H	H	S	H	S	H	S		S	H	S	H	S	S	S
IV	H	H	S	H	S	S	S	S	S	S		H	S	S	S

S = Supportive **H = Highly related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF THE PROGRAM OUTCOMES

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	H	H	S	H	S	H	S		S	S	S	H	S	S	S
2	H	H	S	H	S	S	S		S	S		H	H	S	S
3	H	H	S	H	S	S	H	S	S	S		H	S	S	S
4	H	H	S	H	S	S	S		S	H	S	H	S	S	S
5	H	H	S	H	S	S	S		S	S		H	S	S	S
6	H	H	S	H	S	H	S		S	S		H	H	S	S
7	H	H	S	H	S	S	S	S	S	S		H	S	S	S
8	H	H	S	H	H	S	S		S	S		H	S	S	S
9	H	H	S	H	S	S	S		S	S		H	H	S	S
10	H	H	S	H	S	H	S	S	H	S	S	H	S	S	S
11	H	H	S	H	S	S	H		S	S		H	S	S	S
12	H	H	H	H	H	S	S		S	H		H	S	S	S

S = Supportive **H = Highly related**

Prepared by: Dr. A Jayanth Kumar, Professor

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