INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ENGINEERING PHYSICS

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

<table>
<tr><td>Course Title</td><td colspan="5">ENGINEERING PHYSICS</td></tr>
<tr><td>Course Code</td><td colspan="5">AHS006</td></tr>
<tr><td>Programme</td><td colspan="5">B.Tech</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4">CSE | IT | ECE | EEE</td></tr>
<tr><td>Course Type</td><td colspan="5">Foundation</td></tr>
<tr><td>Regulation</td><td colspan="5">IARE - R16</td></tr>
<tr><td rowspan="3">Course Structure</td><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Lectures</td><td>Tutorials</td><td>Credits</td><td>Laboratory</td><td>Credits</td></tr>
<tr><td>3</td><td>1</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td>Chief Coordinator</td><td colspan="5">Ms. S Charvani, Assistant Professor</td></tr>
<tr><td>Course Faculty</td><td colspan="5">Ms. S Charvani, Assistant Professor
Ms K Sowmya, Assistant Professor
Mr. K Saibaba, Assistant Professor
Mr. V S K Prasada Rao, Assistant Professor
Mr. A Chandra Prakash., Assistant Professor</td></tr>
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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 nano materials, lasers, dielectric and magnetic properties, principles of quantum mechanics and semiconductors physics. 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
Engineering 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.	3	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.	2	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:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	1	Seminar
PSO 2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	-	-
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Develop strong fundamentals of nano materials.
II	Meliorate the knowledge of theoretical and technological aspects of lasers.
III	Correlate principles with applications of the quantum mechanics, dielectric and magnetic materials.
IV	Enrich knowledge in modern engineering materials like semiconductors..

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
AHS010.01	CLO 1	Recall the basic principles of physics.	PO 1 , PO 2	3
AHS010.02	CLO 2	Apply the concepts and principles in solving the problems of physics.	PO 1 , PO 4	3
AHS010.03	CLO 3	Acquire knowledge of basic terms related to dielectric material and different polarization mechanisms.	PO 1 , PO 4	3
AHS010.04	CLO 4	Review the properties of different magnetic materials and magnetization based on orientation of domains.	PO 1 , PO 4	2
AHS010.05	CLO 5	Understand the basic principles involved in the production of Laser light.	PO 1 , PO 2	2
AHS010.06	CLO 6	Describe the construction and working of different types of Laser systems.	PO 1 , PO 2	2
AHS010.07	CLO 7	Explain the basic principles, properties and applications of nanomaterials.	PO 1 , PO 4	1
AHS010.08	CLO 8	Develop knowledge about different techniques of producing nanomaterials.	PO 2 , PO 4	1
AHS010.09	CLO 9	Interpret and verify dual nature of matter wave concept using Davisson & Germer's experiment.	PO 2 , PO 4	2
AHS010.10	CLO 10	Estimate the energy of the particles using Schrödinger's wave equation and apply it to particle in potential box.	PO 1 , PO 2	2
AHS010.11	CLO 11	Recollect the conductivity mechanism involved in semiconductors and calculate carrier concentrations.	PO 1 , PO 4	3
AHS010.12	CLO 12	Discuss about energy gap, direct, indirect band-gap semiconductors and Hall Effect.	PO 1 , PO 2	3
AHS010.13	CLO 13	Correlate different concepts of physics with day to day life applications.	PO 1	3
AHS010.14	CLO 14	Understand the technical importance of dielectric, magnetic and semiconductor materials.	PO 2	2
AHS010.15	CLO 15	Identify the modern engineering devices based on nano materials and Lasers.	PO 2	2

3 = High; 2 = Medium; 1 = Low

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
CLO 1	3	2											1		
CLO 2	3			1									1		
CLO 3	2			2									1		

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

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1,PO2,PO4	SEE Exams	PO1,PO 2,PO4	Assignments	PO 4	Seminars	PO 2
Laboratory Practices	PO1,PO2,PO4	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	LASERS
Lasers: Characteristics of lasers, spontaneous and stimulated emission of radiation, metastable state, population inversion, lasing action, Einstein's coefficients, ruby laser, He-Ne laser, semiconductor diode laser and applications of lasers.	
Unit-III	**NANOMATERIAL**
Nanomaterial: Origin of nanomaterial, nano scale, surface to volume ratio, quantum confinement; Properties of nanomaterials: Physical, chemical, electrical, optical, magnetic and mechanical. Bottom-up fabrication: Sol-gel; Top-down fabrication: Chemical vapour deposition; Applications of nanomaterials, characterization by XRD, TEM.	
Unit-IV	**QUANTUM MECHANICS**
Quantum mechanics: Waves and particles, De Broglie hypothesis, matter waves, Heisenberg's uncertainty principle, Davisson and Germer experiment, Schrodinger's time independent wave equation, physical significance of the wave function, infinite potential well and its extension to three dimensions.	
Unit-V	**SEMICONDUCTOR PHYSICS**
Semiconductor physics: Fermi level in intrinsic and extrinsic semiconductors, calculation of carrier concentration in intrinsic and extrinsic semiconductors, energy gap, direct and indirect band gap semiconductors, Hall effect.	
Text Books:	
1. Dr. K. Vijaya Kumar, Dr. S. Chandralingam, "Modern Engineering Physics", Chand & Co. New Delhi, 1st Edition, 2010. 2. P. K. Palanisamy, "Engineering Physics", Scitech Publishers, 4th Edition, 2014.	
Reference Books:	
1. V. Rajendran, "Engineering Physics", Tata Mc Graw Hill Book Publishers, 1st Edition, 2010. 2. R. K. Gaur, S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Edition, 2001. 3. A. J. Dekker, "Solid State Physics", Macmillan India ltd, 1st Edition, 2000. 4. Hitendra K. Malik, A. K. Singh, "Engineering Physics", Mc Graw Hill Education, 1st Edition, 2009.	

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 3	T1:13.5 R1:1.3
2	Discuss different polarization mechanisms in dielectrics	CLO 3	T1:13.5 R1:1.3
3	Derive expression for total electric field at a given point inside dielectrics.	CLO 3	T1:13.5 R1:1.3
4	Acquire knowledge of basic terms related to magnetic materials.	CLO 4	T1:14.7 R1:3.4
5	Describe magnetic moment in an atom in terms of Bohr Magneton	CLO 4	T1:15.7 R1:4.10
6	Classify different magnetic materials based on electron theory.	CLO 4	T1:16.8 R1:4.15
7	Examine the spontaneous magnetization in ferro-magnets based on orientation of domains.	CLO 4	T1:16.9 R1:5.4
8	Explain the principle involved in Lasers	CLO 5	T1:17.9 R1:5.8
9	Review basic phenomena's of laser	CLO 5	T1:18.10 R1:6.8
10	Acquire knowledge of basic terms related to lasers	CLO 5	T1:19.10

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
			R1:6.13
11	Discuss functioning of laser system	CLO 5	T1:19.9 R1:7.5
12	Derive relation between Einstein's Coefficients	CLO 5	T1:23.10 R1:7.5
13	Explain the principle and working of Ruby laser	CLO 5	T1:23.10 R1:8.1
14	Explain the principle and working of Helium-Neon laser	CLO 5	T1:23.1 R1:9.2
15	Explain the principle and working of semiconductor diode laser	CLO 5	T1:23.1 R1:9.4
16	Explain the principle and working of Helium-Neon laser	CLO 5	T1:23.1 R1:9.9
17	Explain the principle and working of semiconductor diode laser	CLO 5	T1:23.1 R1:9.10
18	Discuss the uses of lasers	CLO 5	T2:27.5 R1:10.2
19	Identify the principle of nano technology	CLO 7	T2:27.7 R1:11.3
20	Recall origin of nanomaterials	CLO 7	T2:27.8 R1:11.6
21	Acquire knowledge of basic principle of nanomaterials.	CLO 7	T2:27.12 R1:11.7
22	Analyze nano material with their properties	CLO 7	T2:27.12 R1:11.8
23	Develop nanomaterials in sol gel method	CLO 8	T2:27.12 R1:11.9
24	Develop nanomaterials chemical method	CLO 8	T2:27.12 R1:11.10
25	Discuss applications of nanomaterials	CLO 8	T2:27.14 R1:12.3
26	Analyze nanomaterials by XRD	CLO 8	T2:27.1 R1:12.7
27	Analyze nanomaterials by TEM	CLO 8	T2:27.17 R1:12.15
28	Understand dual nature of radiation	CLO 9	T2:27.18 R1:12.19
29	Correlate dual nature to material particle	CLO 9	T2:27.19 R2:14.4
30	Analyze matter wave concept mathematically	CLO 9	T2:27.20 R2:14.5
31	Describe matter waves and Heisenberg's Uncertainty Principle	CLO 9	T2:30.19 R2:14.5
32-34	Identify existence of matter wave experimentally	CLO 9	T2:30.20 R2:15.5
35-37	Derive wave equation of matter wave	CLO 9	T2:32.19 R2:16.5
38	Correlate wavefunction to probability density.	CLO 10	T2:32.20 R2:16.5
39-41	Derive the solution of wave equation in terms of Potential box	CLO 10	T2:33.1 R2:16.6
42-44	Apply to three dimensions	CLO 10	T2:34.1 R2:17.1
45-48	Explain basic concepts of semiconductors	CLO 11	T2:35.2 R2:17.2

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
49-55	Derive carrier concentration in intrinsic Semiconductors	CLO 11	T2:36.1 R2:18.1
56-58	Identify Fermi level in semiconductors	CLO 11	T2:39.19 R2:16.5
59	Determine energy gap mathematically	CLO 12	T2:40.19 R2:16.5
60	Compare Direct &Indirect Band Gap semiconductors, hall effect	CLO 12	T2:41.19 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:
Ms. S Charvani, Assistant Professor

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