Hall Ticket No | | | | | | | | | | | Question Paper Code: AHS008

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

MODEL QUESTION PAPER

B.Tech II Semester End Examinations (Regular), May – 2018

Regulation: IARE–R16

MODERN PHYSICS
(Common to AE/ME/CE)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT I

1. (a) Sketch neat diagram depicting structure of simple cubic crystal. Discuss its structure with respect to its coordination number, atomic radius and effective number. Also derive its packing factor. **[7M]**

   (b) Show that in a simple cubic lattice the separation between the successive lattice planes (100), (110) and (111) are in the ratio of 1:0.71: 0.58. **[7M]**

2. (a) Show that face centered cubic structure is the most closely packed compared to simple cubic and body centered cubic structures, by calculating the packing factors. **[7M]**

   (b) Copper has FCC structure and the atomic radius is 0.1278nm. Calculate the interplanar spacing for (110) and (212) planes. **[7M]**

UNIT II

3. (a) State Braggs law of X-ray diffraction. Derive Bragg's law for a set of parallel planes in a crystal with a neat diagram. **[7M]**

   (b) beam of X-rays is incident on an ionic crystal with lattice spacing 0.313 nm. Calculate wavelength of X-rays if the first order Bragg reflection takes place at a glancing angle of $7^o48^{\|}$ **[7M]**

4. (a) What are point defects? Explain, in detail, the different types of point defects with suitable sketches. **[7M]**

   (b) Calculate the glancing angle at (111) plane of a cubic crystal having axial length 0.19nm corresponding to the second order diffraction maximum for the x-rays of wavelength 0.058nm. **[7M]**

UNIT III

5. (a) What are semiconductor diode lasers? Describe the construction and working of a semiconductor diode laser **[7M]**

   (b) Find the relative population of the two states in a ruby laser that produces a light beam of wavelength $6943A^o$ at 300K. **[7M]**

6. (a) What is pressure sensor? Explain the construction and working of any one pressure sensor with a neat sketch. **[7M]**

   (b) Explain how a sensor is calibrated to measure any change in the value taking an example. **[7M]**

UNIT IV

7. (a) Define Numerical aperture. Derive an expression for numerical aperture of an optical fiber in terms of refractive indices of core and cladding. **[7M]**

   (b) Calculate the refractive indices of core and cladding of an optical fiber with a numerical aperture of 0.33 and their fractional differences of refractive indices being 0.02. **[7M]**

8. (a) Draw the block diagram of fiber optic communication system and explain the functions of each block showing importance of optical fiber in communication system. **[7M]**

   (b) The refractive indices of core and cladding materials of a step index fiber are 1.48 and 1.45 respectively. Calculate numerical aperture and acceptance angle. **[7M]**

UNIT V

9. (a) Discuss in detail interference of reflected light in thin films. Find the conditions for constructive and destructive interference in thin films. **[7M]**

   (b) A parallel beam of light of 6000A is incident on thin glass plate of refractive index 1.5 such that the angle of refraction into the plate is 50^o. Find the least thickness of the glass plate which will appear dark by reflection. **[7M]**

10. (a) Give the theory of Fraunhofer diffraction due to a single slit and hence obtain the condition for primary and secondary maxima. Using this obtain intensity distribution curve. **[7M]**

    (b) A plane transmission grating having 4250 lines per cm is illuminated with sodium light normally. In the second order spectrum, the spectral lines are deviated by 30o. What is the wavelength of the spectral line? **[7M]**

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COURSE OBJECTIVES:

The course should enable the students to:

1	Develop strong fundamentals of crystal structures and properties.
2	Meliorate the knowledge of theoretical and technological aspects of lasers.
3	Correlate principles with applications of the x-ray diffraction and defects in crystals.
4	Enrich knowledge in modern engineering principles of interference and diffraction.

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

CAHS008.01	Recall the basic principles of physics and apply these conceptsof physics in solving the real-time problems.
CAHS008.02	Acquire knowledge of basic terms related to crystals, crystal systems, Bravais lattices and Miller Indices.
CAHS008.03	Discuss in detail different crystal structures and calculate their packing factors.
CAHS008.04	Describe different X-ray diffraction in research and development for the study of internal structures of materials.
CAHS008.05	Identify various types of defects in crystals and their effect on structure sensitive properties.
CAHS008.06	Understand the basic principles involved in the production of Laser light and also real-time applications of lasers.
CAHS008.07	Explain the principle involved in working of different types of laser systems.
CAHS008.08	Analyze basic laws of physics to correlate the mechanism of sensors in day to day life. Principle of sensor along with their applications.
CAHS008.09	Understand the importance of various sensors in real-time applications like measurement of pressure in aeronautics, detecting submarines in acoustics.
CAHS008.10	Recollect basic principle, construction, types and attenuation of optical fibers.
CAHS008.11	Apply properties of optical fibers in various real-time applications like measurement of pressure, temperature , displacement etc.
CAHS008.12	Understand the importance of optical fibers in real-time communication system.
CAHS008.13	Interpret phenomenon of interference in thin films using Newton's rings experiment.
CAHS008.14	Identify difference in diffraction phenomenon due to single slit and N-slits.
CAHS008.15	Apply different laws of radiation to understand the phenomenon behind production of light.

Mapping of Semester End Examinations to Course Learning Outcomes:

SEE Question No.		Course Learning Outcomes		Blooms Taxonomy Level
1	a	CAHS008.03	Discuss in detail different crystal structures and calculate their packing factors. .	Understand
	b	CAHS008.03	Discuss in detail different crystal structures and calculate their packing factors. .	Understand
2	a	CAHS008.03	Discuss in detail different crystal structures and calculate their packing factors. .	Understand
	b	CAHS008.03	Discuss in detail different crystal structures and calculate their packing factors. .	Understand
3	a	CAHS008.04	Describe different X-ray diffraction in research and development for the study of internal structures of materials.	Understand
	b	CAHS008.04	Describe different X-ray diffraction in research and development for the study of internal structures of materials.	Understand
4	a	CAHS008.05	Identify various types of defects in crystals and their effect on structure sensitive properties	Understand
	b	CAHS008.04	Describe different X-ray diffraction in research and development for the study of internal structures of materials.	Understand
5	a	CAHS008.07	Explain the principle involved in working of different types of laser systems	Understand
	b	CAHS008.07	Explain the principle involved in working of different types of laser systems	Understand
6	a	CAHS008.08	Analyze basic laws of physics to correlate the mechanism of sensors in day to day life. Principle of sensor along with their applications.	Understand
	b	CAHS008.09	Understand the importance of various sensors in real-time applications like measurement of pressure in aeronautics, detecting submarines in acoustics.	Understand
7	a	CAHS008.10	Recollect basic principle, construction, types and attenuation of optical fibers.	Understand
	b	CAHS008.11	Apply properties of optical fibers in various real-time applications like measurement of pressure,temperature , displacement etc	Understand
8	a	CAHS008.12	Understand the importance of optical fibers in real-time communication system.	Understand
	b	CAHS008.11	Apply properties of optical fibers in various real-time applications like measurement of pressure,temperature , displacement etc	Understand
9	a	CAHS008.13	Interpret phenomenon of interference in thin films using Newton's rings experiment.	Understand
	b	CAHS008.13	Interpret phenomenon of interference in thin films using Newton's rings experiment.	Understand
10	a	CAHS008.14	Identify difference in diffraction phenomenon due to single slit and N-slits.	Understand
	b	CAHS008.14	Identify difference in diffraction phenomenon due to single slit and N-slits.	Understand