

Seat No.	
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F.E. (Semester - I&II) (All Branches) (New Course)

Examination, April - 2017

ENGINEERING PHYSICS

Sub. Code : 59176

Day and Date : Friday, 28 - 04 - 2017

Total Marks : 100

Time : 10.00 a.m. to 1.00 p.m.

- Instructions :**
- 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Given:-

Avogadro's number = 6.02×10^{26} /kg.atom

Planck's constant $h = 6.63 \times 10^{-34}$ J.s

Electronic charge $e = 1.6 \times 10^{-19}$ C

Electron mass $m = 9.1 \times 10^{-31}$ kg

SECTION - I

Q1) Attempt any three from the following questions.

- a) Explain double refraction phenomena in uniaxial crystals and distinguish between Positive and negative crystals. [6]
- b) What is grating? How it is constructed? Explain the use of grating to determine wavelength of spectral lines. [6]
- c) Define the following terms: Optic axis, Principal plane, anisotropic media, optical activity, Specific rotation. [5]
- d) Light of wavelength 5000\AA is incident normally on a plane transmission grating. Find the difference in deviations in the first and third order spectra. The number of lines per cm on grating surface is 6000. [5]

Q2) Attempt any three from the following questions:

- a) Explain the following terms:- [6]
 - i) Spontaneous emission,
 - ii) Stimulated emission
 - iii) Population inversion.

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- b) Write note on holography. [6]
- c) What is total internal reflection? Explain the structure of an optical fiber. [5]
- d) Explain various applications of an optical fiber. [5]

Q3) Attempt any three from the following questions:

- a) What is chain reaction? Define multiplication factor. Explain the concept of critical size, subcritical size and supercritical size of fissile material. [6]
- b) Define nuclear fission. Calculate energy released by the complete fission of 1kg of U^{235} in joule, kWh, and MW day. Assume 1 fission of U^{235} gives 200Mev energy. [5]
- c) Explain Carbon - Nitrogen cycle of stellar thermonuclear reactions. [5]
- d) Write note on fusion power reactor. [5]

SECTION - II

Q4) Attempt any three from the following questions:

- a) Describe any three types of crystal system with axial length, interfacial angle, Bravais lattice, example and diagram. [6]
- b) Define the packing fraction. Show that atomic packing fraction for SC, BCC and FCC crystals are $\pi/6$, $\sqrt{3}\pi/8$ and $\sqrt{2}\pi/6$, respectively. [6]
- c) Explain construction and working of Bragg's X-ray spectrometer. [5]
- d) Molybdenum has atomic mass 96 with density 10.3 gm/cm^3 . The edge length of unit cell is 3.14 \AA . Find the lattice structure and atomic radius. [5]

Q5) Attempt any three from the following questions:

- a) Explain wave-particle duality of light and obtain an expression for the wavelength of matter waves. [6]
- b) i) State and explain Compton Effect. [3]
ii) An electron is accelerated through a potential difference of 10 kV. Calculate the de-Broglie wavelength and momentum of electron. [3]
- c) Write note on Heisenberg's uncertainty principle. [5]
- d) X-ray with energy of 300 keV undergo Compton scattering with a target. If the scattered X-rays are detected at 30° relative to the incident X-rays, determine the Compton shift at this angle, the energy of the scattered x-ray and the recoil energy of the electron. [5]

Q6) Attempt any three from the following questions:

- a) Explain in brief top down and bottom up approaches used in synthesis of nanomaterials. [6]
- b) With neat diagram explain construction and working of Scanning Tunneling Microscope. [5]
- c) Discuss any five applications of Nanomaterials. [5]
- d) Write a note on carbon nanotube. [5]

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