Reg. No. | | | | | | | | | | | | |

Question Paper Code : 27663

B.E./B.Tech. DEGREE EXAMINATION, DECEMBER 2015/JANUARY 2016

First Semester

Civil Engineering

PH 6151 – ENGINEERING PHYSICS – I

(Common to all Branches)

(Regulations - 2013)

Time : Three Hours **Maximum : 100 Marks**

Planck's constant	$= 6.62 \times 10^{-34}$ Js
Speed of light	$= 3 \times 10^{8}$ ms^{-1}
Electron rest mass	$= 9.11 \times 10^{-31}$ kg
Proton rest mass	$= 1.67 \times 10^{-27}$ kg

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Draw the Bravais lattices belonging to the orthorhombic crystal system.

2. Calculate the volume of an FCC unit cell in terms of the atomic radius R.

3. When a wire is bent back and forth, it becomes hot. Why?

4. A metal cube takes 5 minutes to cool from 60 °C to 52 °C. How much time will it take to cool to 44 °C, if the temperature of the surroundings is 32 °C ?

5. The room temperature (27 °C) thermal neutrons are used in the neutron diffraction experiments. Calculate the de Broglie wavelength associated with these neutrons. The rest mass of the neutron, m_n, is 1.6748×10^{-27} kg.

6. Why should the wavefunction of a particle be normalized ?

7. A single mosquito create a sound level of 0 dB. What will be total sound intensity level of 200 such mosquitoes ?

8. In magnetosriction method, calculate the fundamental frequency of ultrasonic waves to be produced by 3.6 cm length of a copper rod fixed at its centre. The speed of sound in this rod is 3600 m/s.

9. For a laser at 2.0 m distance from the laser output beam spot diameter is 6.0 mm and beam divergence is 1.2 mrad. Calculate the beam spot diameter at 5.0 m distance from the laser output.

10. Why is intermodal dispersion reduced in graded-index fibers ?

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Discuss in detail a suitable method to grow single crystal of semiconducting materials. **(12)**

(ii) Metallic iron changes from BCC to FCC at 910 °C and corresponding atomic radii vary from 1.258 Å to 1.292 Å. Calculate the percentage volume change during this structural change. **(4)**

OR

(b) (i) Calculate the packing fraction of FCC and HCP. **(12)**

(ii) A hypothetical compound AB is crystallized in simple cubic structure. In this structure the atom A is at the corners and the atom B is at the centre of the unit cell. If the diameter of the atom A is double that of atom B, calculate the packing factor. **(4)**

12. (a) (i) Derive the expression for the Young's modulus of a cantilever beam and explain the experiment to determine the Young's modulus of a cantilever beam. **(12)**

(ii) A uniform rectangular bar of 1.0 m long, 2.5 cm breadth and 4.9 mm thickness is supported on its flat face symmetrically on two knife-edges 80 cm apart. If loads of 0.125 kg are hung from the two ends, calculate the radius of the curvature of the bar in equilibrium position. Young's modulus of the materials is 12×10^9 N/m^2. (4)

OR

(b) (i) Describe the theory of radial flow of heat and explain the experiment of determining coefficient of thermal conductivity of a thick rubber pipe through which steam is flowing. (12)

(ii) Write down the formula for the coefficient of thermal conductivity of square shaped thin bad conductor in the Lees' disc method. In this experiment instead of metallic disc, metallic square plate is used. (4)

13. (a) (i) Derive Planck's law for black body radiation. (12)

(ii) The wavelength of the scattered X-ray photons are determined to be 1.000 Å by the detector at an angle θ° in a Compton experiment. If the wavelength of the scattered photons are found to be 1.018 Å by rotating the detector increasingly through 60° further, then calculate the angles of the scattered X-ray photons. (4)

OR

(b) Derive the time dependent Schrodinger wave equation from that obtain time-independent wave equation. (16)

14. (a) Obtain Sabine's expression for reverberation in a hall. (16)

OR

(b) (i) Explain with neat diagram, principle, construction, working of piezoelectric method to produce ultrasonics. (12)

(ii) Two ships A and B are anchored at some distance away in the deep sea. An ultrasonic signal of 50 kHz is sent simultaneously from one ship to another by two routes through sea-water and through air. The speeds of sound in sea-water and in air are 1372 m/s and 343 m/s. If the signals are received in the ship with the time gap of 3 s, then calculate distance between the two ships. (4)

15. (a) Describe the construction and working of CO_2 laser with neat diagram and write down its applications. (16)

OR

(b) (i) Obtain the expression for numerical aperture of an optical fiber. (12)

(ii) For a heterojunction semiconductor laser, the band gap of the semiconductor used is 1.44 eV. By doping, the band gap of the semiconductor is increased by 0.2 eV. Calculate the change in the wavelength of the laser. (4)