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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Annual Pattern — First Year

Civil Engineering

PH 1 X 01 — ENGINEERING PHYSICS

(Common to all branches)

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A sound with an intensity level of 20 dB is how many times more intense than a sound with intensity level of 0 dB.

2. How can you determine the molecular weight of the compound given its crystal structure and lattice parameters?

3. The core of an optical fibre made of glass with refractive index equal to 1.55 and clad has refractive index 1.5. Calculate the critical angle for total internal reflection and maximum acceptance angle at the air-core interface.

4. Give the principle of working of semiconductor laser diode.

5. What are the drawbacks of classical free electron theory?

6. An electron is confined between two impenetrable walls 2.0 Å apart. Find the lowest energy possessed by the electron.

7. N is added to Si and B is added to Ge in small proportions which act as a substitutional impurity. What will be the type of semiconductor formed? Give reasons.

8. Give any four properties of superconductors.

9. Explain the term polarization in solids.

10. Explain the basic principle of liquid penetrant inspection method.

PART B — (5 × 16 = 80 marks)

11. (a) (i) How does the reverberation time affects the acoustics of auditorium? Derive Sabine's formula for standard reverberation time. (12)

    (ii) A hall of volume 4000 m^3 has a reverberation time of 4.2 s. How will you reduce the reverberation time of the hall to 2.1 s, using a material whose sound absorption co-efficient is 0.48 OWU. (4)

    Or

    (b) (i) Show that for an ideal h.c.p structure the c/a ratio is 1.633. Also show that it is a close packed structure. (6 + 4)

    (ii) Explain the method of determination of velocity of ultrasonic waves in liquids by forming an acoustic grating. (6)

12. (a) (i) Describe the construction and working of Michelson's interferometer. How can it be used to determine the wavelength of the monochromatic source of light? (12)

    (ii) What are quarter and half wave plates? Give their applications. (4)

    Or

    (b) (i) Describe the construction and working of Nd:YAG laser with necessary theory. How is this laser more efficient than a ruby laser? (8 + 2)

    (ii) With a neat block diagram explain the fibre optic communication system. (6)

13. (a) (i) What is Compton effect? Derive an expression for Compton shift. (12)

    (ii) Based on energy band diagram distinguish between conductors, insulators and semiconductors. (4)

    Or

    (b) (i) Derive an expression for number of energy states/unit volume lying between the energy interval E and E+dE. Hence obtain an expression for carrier concentration in metals. (12)

    (ii) A copper wire of area of cross-section 1 mm^2 carries a current of 1 amp. Calculate the drift velocity of electrons. Given, Cu is monovalent, the density and atomic weight of Cu are 8960 kg/m^3 and 63.5 respectively. (4)

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14. (a) (i) Derive an expression to determine the position of the Fermi level in an intrinsic semiconductor and show that it lies in the middle of the band gap at T = 0 K. (12)

   (ii) The energy gap in germanium is 0.67 eV. The electron and hole effective masses are $0.12\ m_e$ and $0.23\ m_e$ respectively, where m_e is the free electron mass. Calculate the Fermi energy at T= 0 K and at T = 300 K. (4)

Or

   (b) (i) Explain Hall effect in semiconductors. Deduce an expression for Hall coefficient for a n-type semiconductor. (8)

   (ii) Explain Type I and Type II superconductors. (4)

   (iii) Explain high temperature superconductors. Compare with conventional superconductors. (4)

15. (a) (i) Discuss the different kinds of breakdown in dielectrics. Give the major applications of dielectrics. (10)

   (ii) What are metallic glasses? Explain their use as a transformer core material. (6)

Or

   (b) (i) What are nanophase materials? How does their physical property vary with geometry? (8)

   (ii) Draw the block diagram of ultrasonic flaw detector. Explain how it can be used for detecting flaws in specimens. (8)

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