

## FACULTY OF ENGINEERING &amp; INFORMATICS

B.E. (I-Year) (Common to all Branches) (Supplementary) Examination, January 2011  
ENGINEERING PHYSICS

Time : Three Hours]

[Maximum Marks : 75

*Answer ALL questions of Part A. Answer FIVE questions from Part B.***PART—A** (Marks : 25)

1. Deduce the missing orders of a double slit Fraunhofer diffraction pattern if the slit widths are 0.16 mm and they are 0.8 mm apart. 2
2. Define the following :
  - (a) Population inversion
  - (b) Pumping
  - (c) Active medium. 3
3. A particle is moving in a one-dimensional potential box of infinite height. What is the probability of finding the particle in a small interval  $\Delta x$  at the centre of the box when it is in the energy state, next to least energy state ? 3
4. Two particles came towards each other with speed 0.8 times the velocity of light with respect to laboratory. What is their relative speed ? 3
5. In a plane electromagnetic wave in free space the ratio of electric and magnetic field vectors i.e. E and B is given by :
 

(a) $\frac{B}{E} = C$	(b) $\frac{E}{B} = C$
(c) $\frac{B}{E} = \mu_0 \epsilon_0$	(d) $\frac{E}{B} = \mu_0 \epsilon_0$
6. Among the crystal structures which has the highest packing fraction ?
 

(a) BCC	(b) FCC and HCP
(c) Diamond	(d) Hexagonal <span style="float: right;">2</span>

7. Match the following :

- |                            |  |
|----------------------------|--|
| (1) Optical Fibers         | (a) Orbital and spinning motion of electrons in atom |
| (2) At 0 K a semiconductor | (b) Production of electricity by temperature         |
| (3) Magnetism              | (c) Production of electricity by pressure            |
| (4) Piezoelectric effect   | (d) Ferromagnetic                                    |
| (5) Cobalt                 | (e) Total internal reflection                        |
|                            | (f) Acts as insulator                                |
|                            | (g) Acts as a superconductor                         |

(A) 1-c, 2-g, 3-d, 4-a, 5-f

(B) 1-e, 2-f; 3-a, 4-c, 5-d

(C) 1-d, 2-a, 3-c, 4-b, 5-g

(D) 1-e, 2-d, 3-b, 4-c, 5-g

8. Mention few applications of Ferrites. 2

9. Plane polarized light of wavelength  $6000\text{\AA}$  is incident on a thin quartz-plate cut with faces parallel to the optic axes. Calculate the minimum thickness of the plate for which the ordinary and extraordinary waves will combine to produce plane polarized light. 3

10. What is Meissner effect in superconductors ? Explain. 2

**PART—B (Marks : 50)**

11. (a) Describe the construction of Nicol Prism and how it can be used for the study of polarization of light ? 5

(b) Describe the double crucible method for drawing the optical fibers. 5

12. (a) Explain the basic principle of Holography technique. 2

(b) Explain how a hologram is recorded and viewed. 5

(c) Describe the step index and graded index optical fibers. 3

13. (a) Explain the Boltzmann's theorem on entropy and probability. 3

(b) What are Fermions ? Obtain the Fermi-Dirac distribution function for Fermions. 5

(c) Define Fermi energy. 2

14. Using Schrödinger's time independent wave equation discuss the nature of matter waves moving across a potential barrier and discuss the phenomenon of quantum tunnelling. 10
15. (a) Obtain the Bragg's law for X-ray diffraction. 3  
(b) Describe in detail the powder diffraction experiment to determine the lattice constraints of cubic system. 7
16. (a) Distinguish between intrinsic and extrinsic semiconductors. 3  
(b) Obtain an expression for Carrier concentration in intrinsic semi-conductors and show that the Fermi-energy level lies half way between valance band and conduction band. 7
17. (a) What are dielectrics ? Explain different types of electric polarization mechanisms contributing to the total polarization of dielectric materials. 6  
(b) Explain the NMR technique used for the analysis of materials. 4