Code No. : 6004

# FACULTY OF ENGINEERING AND INFORMATICS
## B.E. I Year (Common to All Branches) (Main) Examination, June 2010
## ENGINEERING PHYSICS

Time: 3 Hours] [Max. Marks: 75



*Note : 1) Answer **all** questions of Part – A*
*2) Answer **five** questions from Part – B*

PART – A **(25 Marks)**

1. In Newton's rings experiment the diameters of the $14^{th}$ and $12^{th}$ dark rings are 4 mm and 7 mm respectively. Find the diameter of the $20^{th}$ dark ring. 3

2. Using diffraction grating with 5000 lines per cm. and opaque spaces exactly two times the transparent spaces, find which order of spectra will be absent. 2

3. The position and momentum of a 1 keV electron are simultaneously determined. If its position is located to with-in-1$\mathring{A}$, what is the percentage of uncertainty in its momentum ?
($m_e = 9.109 \times 10^{-31}$ kg, $e = 1.602 \times 10^{-19}$C) 3

4. How much energy could be obtained theoretically by annihilation of 1 gm of matter ? 2

5. At any point in the electromagnetic cavity resonator energy stored per unit volume of the field is given by u, then u is equal to 2

a) $\frac{1}{2}\varepsilon_0 E^2$ b) $\frac{1}{2\mu_0}B^2$

c) $\frac{1}{2}\varepsilon_0 E^2 - \frac{1}{2\mu_0}B^2$ d) $\frac{1}{2}\varepsilon_0 E^2 + \frac{1}{2\mu_0}B^2$

6. The number of nearest neighbours for a _____ lattice is _____ 2

a) BCC, 8 b) FCC, 10

c) HCP, 8 d) FCC, 4

7. Match the following : 3

| | |
|---|---|
| 1) Solar cells | a) P-type semiconductor |
| 2) Silicon doped with gallium | b) Charge storage |
| 3) Ferrites | c) Repel all the magnetic lines of force passing through it |
| 4) Dielectric materials | d) Photo voltaic effect |
| 5) Superconductor | e) n-type semiconductor |
| | f) Attract the magnetic field towards its centre |
| | g) Ferrimagnetic materials |

A) 1 – a, 2 – c, 3 – g, 4 – b, 5 – c

B) 1 – c, 2 – f, 3 – a, 4 – a, 5 – g

C) 1 – d, 2 – a, 3 – g, 4 – b, 5 – c

D) 1 – e, 2 – c, 3 – b, 4 – a, 5 – f

8. Distinguish between X-ray fluorescence and Auger processes. 3

9. A plane polarized light of wave length 6000 Å is incident on a thin quartz plate cut with faces parallel to the optic axis. Calculate the minimum thickness of the plate which introduces a phase difference 60° between the ordinary and extra-ordinary rays. 3

10. Explain the effect of magnetic field on a superconductor. 2

## PART – B (50 Marks)

11. a) Derive an expression for the intensity at a point in the Fraunhofer type of diffraction produced by two nearby parallel narrow slits illuminated by monochromatic light. 7

    b) Draw a diagram to indicate the distribution of intensity. 3

12. a) Distinguish between spontaneous emission and stimulated emission. 3

    b) Draw a neat diagram to represent the components of a Ruby laser and explain its operation. 7

13. a) Explain the Heisenberg's uncertainty principle. 4

    b) Obtain Schrodingers time dependent and time independent wave equations for matter waves. 6

14. a) State the fundamental postulates of special theory of relativity. 2

    b) Obtain the expression for relativistic variation of mass (m) with velocity (v) and discuss the possible conditions i.e. 8

    i) $v << c$

    ii) $v \approx c$

    iii) $v \geq c$.

15. a) Write the Maxwell's equations in integral and differential forms. 3

    b) Using Maxwell's equations obtain the expression for wave equations of transverse electric and magnetic fields in free space and show that electric and magnetic fields travel with the speed of light. 7

16. a) Write down the salient features of Kronig-Penny model and on the basis of this model discuss the classification of solids into conductors, semi-conductors and insulators. 6

    b) What are point defects ? Explain the Schottky and Frenkel defects. 4

17. a) Describe the thermal evaporation method of preparation of thin films in vacuum. 5

    b) Describe ESR spectrometer and explain how ESR spectra are used in the analysis of materials. 5

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