

Total No. of Questions : 8]

SEAT No. :

P4418

[Total No. of Pages : 3

[5251]-1002

F.E. First Year (Engineering) (II Semester)

ENGINEERING PHYSICS

(2015 Pattern)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Neat diagram must be drawn wherever necessary.
- 2) Figure to the right indicate full marks.
- 3) Use of logarithmic table, slide rule, mollier charts, Electronics Calculator, and steam table is allowed.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain the theory of formation of Newton's Rings? Hence, explain how the refractive index of liquid can be determined. [6]
- b) How many lines per cm are there on the surface of a plane transmission grating which gives 1<sup>st</sup> order of light of wavelength 6000Å at an angle of diffraction 30°. [3]
- c) List any three applications of ultrasonics. Explain any one of them in brief. [3]

OR

- Q2)** a) What is reverberation? Give Sabine's formula for reberberation time. What are the factors affecting reberberation time? Explain how it can be optimized by controlling these factors. [6]
- b) Calculate the length of an iron rod which can be used to produce ultrasonic waves of frequency 20 kHz Given, Young's modulus of iron  $1.16 \times 10^{11} \text{ N/m}^2$ . Density of iron =  $7.23 \times 10^3 \text{ kg/m}^3$  [3]
- c) The resultant amplitude of a wave when monochromatic light is diffracted from a single slit  $E_\theta = E_m (\sin \alpha)/\alpha$ , specify the terms involved and derive condition of minima. [3]

P.T.O.

**Q3) a)** What are retardation plates? Give their types? Derive the expression for thickness for any one of them. [6]

b) Define the following: [3]

i) Stimulated emission

ii) Metastable State

iii) Population Inversion.

c) Calculate the band gap energy (in eV) in silicon, given that it is transparent to radiation of wavelength greater than 11000 Å.

$h : 6.63 \times 10^{-34} \text{ J-sec}, c = 3 \times 10^8 \text{ m/s}$  [3]

OR

**Q4) a)** Explain the working of P-N junction diode in [6]

i) Zero bias

ii) Forward Bias

iii) Reverse Bias

On the basis of energy level diagram.

b) The Hall coefficient of a specimen of doped silicon is found to be  $3.66 \times 10^{-3} \text{ m}^3/\text{C}$ . The resistivity of the specimen is  $8.93 \Omega\text{-m}$ . Determine the mobility of charge carriers. [3]

c) What is an optical resonator? What is its role in lasing? [3]

**Q5) a)** State and explain Heisenberg's Uncertainty Principle. Show that it is also applicable for energy and time. [6]

b) State and explain de-Broglie hypothesis of matter waves. Explain in brief any two properties of matter waves. [4]

c) Lowest energy of an electron trapped in an infinite potential well is 38 eV. Calculate the width of the well. ( $e = 1.6 \times 10^{-19} \text{ C}, h = 6.63 \times 10^{-34} \text{ J-sec}, m_e = 9.1 \times 10^{-31} \text{ kg}$ ) [3]

OR

- Q6)** a) Starting from de-Broglie hypothesis, derive Schrödinger's time independent wave equation. [6]  
b) Explain tunneling effect. How is this principle used in a tunnel diode. [4]  
c) Calculate the de-Broglie wavelength for a 10 KeV proton. [3]  
( $m_p = 1.67 \times 10^{-27}$  kg,  $h = 6.63 \times 10^{-34}$  J.s,  $e = 1.6 \times 10^{-19}$  C).

- Q7)** a) Explain the following terms of superconductivity with the help of necessary figure. Give formula and graph wherever necessary. [6]  
i) Meissner effect  
ii) Critical Magnetic Field  
b) Give brief explanation of the optical properties of nanoparticles with the help of quantum confinement effect and Mie equation. [4]  
c) Explain the formation of Cooper pairs in superconductors with the help of electron phonon interaction. [3]

OR

- Q8)** a) Explain chemical method for synthesis of nanoparticles by colloidal route with the help of LaMer diagram. Give one example of synthesis of metal nanoparticles. [6]  
b) Give the statement of Meissner effect and show that super conductors are perfectly diamagnetic. [4]  
c) Explain the Mechanical properties of Nanoparticles [3]

