Total No. of Questions :8]

SEAT No. :

P4024

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F.E.

ENGINEERING PHYSICS

(2015 Pattern) (Semester - I & II)

Time : 2 Hours] *[Max. Marks :50*

Instructions to 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) How are Newton's Rings experimentally obtained? Derive an expression for the diameter of bright rings in reflected system and show that it is proportional to the square root of an odd natural number. **[6]**

b) Find the half angular width of the central maxima in the Fraunhofer diffraction pattern due to a single slit having a width of 7.07×10^{-5}cm, when illuminated by light having wavelength 5000 AU. **[3]**

c) Find the echo time of ultrasonics pulse which is travelling with the velocity 3.1×10^{3} m/s in mild steel. The correct thickness measured by gauss meter is 9mm. **[3]**

OR

Q2) a) What is revereberation? Give Sabine's formula for reberation time. What are the factors affecting reberberation time? Explain how it can be optimized by controling these factors. **[6]**

b) Calculate the natural frequency of vibrations for a quartz plate of thickness 5.5 mm. ($Y = 8 \times 10^{10}$ N/m^2 and $\rho = 2650$ kg/m^3) **[3]**

c) Explain with a suitable diagram how the principle of interference is used in an anti-reflection coating. Derive an expression for its thickness. **[3]**

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Q3) a) State the phenomena of double refraction. Hence explain Huygen's theory of double refraction. **[6]**

b) State the characteristics of laser beam and explain any one of them in brief **[3]**

c) What is Fermi Dirac probability distribution function? Give the meaning of all terms in it. **[3]**

OR

Q4) a) What is photovoltaic effect? Explain the construction and working of solar cell. Also draw the IV characteristics of solar cell & define fill factor **[6]**

b) Calculate the number of acceptors to be added in germanium sample to obtain the resistivity of 20 Ωcm. Given:- μ_h = 1700 cm^2/V.sec, e = 1.6$\times$ 10^{-19}C **[3]**

c) What is difference between normal photography and holography? which property of lasers is most useful to record a hologram? **[3]**

Q5) a) State and explain Heisenberg's uncertainty principle. Illustrate it by an experiment of diffraction at a single slit **[6]**

b) State de-Broglie hypothesis of matter waves. Derive the expression for matter waves for an accelerating particle in terms of its kinetic energy. **[4]**

c) Calculate the first energy eigen value of electron in eV trapped in rigid box of length 1 AU. (e = 1.6 $\times 10^{-19}$ C, h = 6.63 $\times 10^{-34}$ J-sec, m_e = 9.1 $\times 10^{-31}$ kg) **[3]**

OR

Q6) a) Derive equation of energy when a particle is confined to an infinite potential well. Draw first three energy levels for an electron confined in it. **[6]**

b) Explain wave-function ψ. Give the physical significance of $|\Psi^2|$. **[4]**

c) A proton and an alpha particle are accelerated by the same potential difference. Find the ratio of their de-Broglie wavelength. ($m_\alpha = 6.68\ 0^{-27}$ kg, charge on alpha particle = 2 $\times$ Charge on electron, $m_p = 1.673 \times 10^{-27}$ kg) **[3]**

Q7) a) What is superconductivity? Explain BCS theory of superconductors. **[6]**

b) Explain the mechanical method, high energy ball milling to synthesize nanoparticles with the help of a neat and suitable diagram **[4]**

c) The critical temperature for lead is 7.2K. However at 5K it loses its superconductivity when subjected to a magnetic field of 3.3×10^4 A/m. Find the maximum value of critical magnetic field which will allow the metal to retain its superconductivity at 0K. **[3]**

OR

Q8) a) Explain the optical and electrical properties of nanoparticles. **[6]**

b) Give any four points to distinguish between Type I & Type II superconductors **[4]**

c) List the applications of nanotechnology in the field of automobile. Explain any one application in brief **[3]**