Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4956]-102

F.E. EXAMINATION, 2016

ENGINEERING PHYSICS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data, if necessary.

(*v*) *All* questions are compulsory.

Constants :— (*i*) Mass of electron = $m_e = 9.1 \times 10^{-31}$ kg

(*ii*) Charge on electron = $e = 1.9 \times 10^{-19}$ C

(*iii*) Mass of proton = $m_p = 1.673 \times 10^{-27}$ kg

(*iv*) Mass of neurton = $m_n = 1.675 \times 10^{-27}$ kg

(*v*) Planck's constant = $h = 6.63 \times 10^{-34}$ J.s.

(*vi*) Velocity of light = $c = 3 \times 10^{8}$ m/s

1. (*a*) For a plane diffraction grating, starting from the equations of resultant amplitude and intensity, derive conditions for maxima and minima of the diffraction pattern. [6]

P.T.O.

(*b*) Explain how ultrasonic waves are used for detection of flaws in metal. [3]

(*c*) A hall of dimensions 20 m × 20 m × 20 m has a reverberation time of 1.2 sec. Find average absorption coefficient. [3]

Or

2. (*a*) What is magnetostriction effect ? Explain construction and working of magnetostriction oscillator. [6]

(*b*) Explain with suitable diagram how interference is used to design anti-reflection coating. [3]

(*c*) A parallel beam of light 622 nm incident on a glass plate of refractive index 1.5 such that angle of refraction into the plate is 60°. Calculate the smallest thickness of the plate which will appear dark by reflection. [3]

3. (*a*) What is double refraction ? Explain this phenomenon on the basis of Huygen's theory. [6]

(*b*) What is Fermi energy in semiconductor ? With the help of labeled diagram show the position of Fermi level in the case of a diode that is connected in forward bias. [3]

(*c*) Calculate the number of acceptor atoms that need to be doped in germanium sample to obtain the resistivity of 8 Ω cm. [Given : mobility $\mu = 1600\ cm^2/V.s$] [3]

Or

4. (*a*) Derive an expression for conductivity in case of intrinsic and extrinsic semiconductors. [6]

(*b*) What is stimulated emission of radiations ? Explain its significance in production of laser. [3]

(*c*) Explain any *one* engineering application of laser. [3]

5. (*a*) Deduce Schrödinger's time independent wave equation. [6]

(*b*) State and explain Heisenberg's uncertainty principle. [4]

(*c*) Calculate de Broglie wavelength for a proton moving with velocity 1 percent of velocity of light. [3]

Or

6. (*a*) Define phase velocity and group velocity. Show that group velocity is equal to particle velocity. [6]

(*b*) Explain why probability of finding of a particle cannot be predicted by the interpretation of wave function ψ. Explain physical significance of $|\psi|^2$. [4]

(*c*) A neutron is trapped in an infinite potential well of width 10^{-14} m. Calculate its first energy eigenvalue in eV. [3]

7. (*a*) Explain BCS theory of superconductivity. Mention why superconductivity is observed below critical temperature. [6]

(*b*) Explain any *one* method for synthesis of nano-particles. [4]

(*c*) Explain the applications of nano-particles in the field of automobiles. [3]

Or

8. (*a*) Why are the properties of nano-particles different from that of the bulk materials ? Explain any *two* properties of nano-particles. [6]

(*b*) Explain in brief : [4]

(*i*) Meissner effect

(*ii*) Critical magnetic field.

(*c*) Explain the applications of superconductors in the field of electronics. [3]