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

Seat No.	

[5667]-105

F.E. EXAMINATION, 2019

ENGINEERING PHYSICS

(2015 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.

Given : $e = 1{\cdot}6 \times 10^{-19}$ C

$h = 6{\cdot}63 \times 10^{-34}$ Js

$c = 3 \times 10^{8}$ m/s

$m_e = 9{\cdot}1 \times 10^{-31}$ kg

1. (*a*) Explain the theory of formation of Newton's rings. Prove that the diameters of bright rings are proportional to square root of odd natural numbers. [6]

(*b*) Explain the following : [3]

(*i*) Piezoelectric effect

(*ii*) Magnetostriction effect

with diagrams.

P.T.O.

(*c*) Calculate the depth of sea if the time interval between the emitted signal and the echo received is 2 sec. in SONAR studies. Assume the velocity in sea water as 1490 m/s. [3]

Or

2. (*a*) Derive the equation for resultant amplitude in Fraunhofer diffraction due to single slit and obtain the conditions to principal maximum and minima. [6]

(*b*) Explain any *two* factors with remedies which affect architectural acoustics of auditorium. [3]

(*c*) In a Newton's rings experiment, the diameter of certain bright ring is 0·65 cm and that of 10th bright, ring beyond it is 0·95 cm. If λ = 6000 Å, calculate the radius of curvature of a convex lens in contact with glass plate. [3]

3. (*a*) Explain Huygen's theory of double refraction. [6]

(*b*) Draw the energy band diagrams for *p-n* junction diode in :

(1) Zero bias

(2) Forward bias

(3) Reverse bias conditions. [3]

(*c*) Calculate the conductivity of pure silicon at room temperature when the concentration of charge carriers is $1{\cdot}6 \times 10^{10}$ per cm^3. Given : μ_e = 1500 cm^2/volt-sec, μ_h = 500 cm^2/volt-sec.

Or

4. (*a*) Define Fermi level in conductors. Using Fermi-Dirac probability distribution function, show that Fermi level in intrinsic semiconductor lies exactly at centre of the band gap. [6]

(*b*) Explain the following : [3]

(*i*) Stimulated emission

(*ii*) Population inversion

(*iii*) Metastable state.

(*c*) Explain the construction process in holographic technique. [3]

5. (*a*) Derive Schrodinger's time independent wave equation. [6]

(*b*) State de Broglie hypothesis. Derive the equation for de Broglie wavelength in terms of kinetic energy. [4]

(*c*) An electron in an infinite potential well is in ground state. Find the fourth energy level of electron in eV. [3]

Or

6. (*a*) Define phase velocity and group velocity. [6]

Show that :

(*i*) Phase velocity of matter waves is e^2/v.

(*ii*) Group velocity of matter waves is equal to particle velocity.

(*b*) Explain the physical significance of wave function ψ and $|\psi|^2$. [4]

(*c*) Find the de Broglie wavelength of electron of energy 10 keV. [3]

7. (*a*) Define superconductivity. Distinguish between Type-I and Type-II superconductors. [6]

(*b*) Explain synthesis of nanoparticles using ball milling method. [4]

(*c*) Explain any *two* applications of Nanotechnology in brief. [3]

Or

8. (*a*) How can gold nanoparticles be synthesized using colloidal route ? Explain the nucleation and growth of nanoparticles using LaMer diagram. [6]

(*b*) Explain the BCS theory of superconductors. [4]

(*c*) The critical temperature of a superconductor with isotopic mass 200 is 5K. Calculate the critical temperature of superconductor when isotopic mass is 196. [3]