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

Seat No.	

[4856]-202

F.E. EXAMINATION, 2015

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 :

$h = 6.63 \times 10^{-34}$ J.sec

$e = 1.6 \times 10^{-19}$ C

$m_e = 9.1 \times 10^{-31}$ kg

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

1. (*a*) Prove that in Newton's rings by reflected light the diameter of dark ring is proportional to square root of a natural number. [6]

(*b*) Explain any *two* factors affecting the acoustics of a hall and remedies on that. [3]

(*c*) The classroom has dimension, $20 \times 15 \times 5$ m^3. The reverberation time is 3.5 sec. Calculate the total absorption of its surface and the average absorption. [3]

P.T.O.

Or

2. (*a*) Explain piezoelectric effect. Explain how piezoelectric oscillator is used to produce ultrasonic waves, with the help of a neat circuit diagram. [6]

(*b*) The resultant amplitude of a wave when monochromatic light is diffracted from a single slit is $E_\theta = E_m \frac{\sin \alpha}{\alpha}$. Then derive the condition of minima. [3]

(*c*) A soap film having refractive index 1.33, and thickness 5×10^{-5} cm is viewed at an angle of 35° to the normal. Find the wavelengths of light in the visible spectrum which will be absent from the reflected light. [3]

3. (*a*) Explain construction and working of Ruby Laser with the help of energy level diagram. [6]

(*b*) What is Fermi level ? Explain Fermi-Dirac probability distribution function. [3]

(*c*) Plane polarized light of wavelength 5×10^{-5} cm is incident on a piece of quarter cut parallel to the optic axis. Find the least thickness of quarter for which the O-ray and E-ray combine to form plane polarized light. [3]

Given : $\mu_0 = 1.5442$, $\mu_e = 1.5633$.

Or

4. (*a*) Explain Hall effect. Derive the equation of Hall voltage and Hall coefficient. [6]

(*b*) State and prove Malus law. [3]

(*c*) Calculate the number of acceptors to be added to a germanium sample to obtain the resistivity of 20 Ω cm. [3]

Given :

$$\mu = 1700 \text{ cm}^2/\text{V.sec}.$$

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

(*b*) Define phase (wave) velocity. Show that the phase velocity of matter wave is greater than the velocity of light. [4]

(*c*) Calculate the de Broglie wavelength of electron of energy 1 keV. [3]

Or

6. (*a*) State Heisenberg's uncertainty principle and prove it by thought experiment of electron diffraction at a single slit. [6]

(*b*) What is wave function ? Explain what is normalization of wave function. [4]

(*c*) The lowest energy of an electron trapped in a rigid box is 4.19 eV. Find the width of the box in A.U. [3]

7. (*a*) Explain : [6]

(*i*) Critical field

(*ii*) Meissner effect.

(*b*) Explain any *two* properties of nano-particles in brief. [4]

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

Or

8. (*a*) Explain the synthesis of nano-particles by chemical method in colloidal form with diagram and example. [6]

(*b*) Explain in brief the BCS theory of superconductivity. [4]

(*c*) Give any *six* applications of superconductivity. [3]