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[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 :

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

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

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

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

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, $20 \times 15 \times 5 \text{ m}^3$. 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 : $\mu_o = 1.5442$, $\mu_e = 1.5633$.

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 $20 \Omega \text{ cm}$. [3]

Given :

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

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]

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