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**[5056]-12****F.E. EXAMINATION, 2016****ENGINEERING PHYSICS****(2015 PATTERN)****Time : Two Hours****Maximum Marks : 50****N.B. :—** (i) Figures to the right indicate full marks.

(ii) Assume suitable data, if necessary.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of Non-Programmable calculator is allowed.

**Physical Constants :**Avogadro's number =  $6.023 \times 10^{23}$  gms/moleCharge on electron (e) =  $1.6 \times 10^{-19}$  CPlanck's constant (h) =  $6.63 \times 10^{-34}$  J-sec.Mass of electron ( $m_e$ ) =  $9.1 \times 10^{-31}$  kg.Velocity of light (c) =  $3 \times 10^8$  m/sec.

1. (a) Derive expression for path difference in reflected light and derive the conditions for constructive and destructive interference for a film of uniform thickness. [6]
- (b) Explain any *one* application of ultrasonic waves. [3]

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- (c) The average reverberation time of a hall is 1.5 sec and the area of the interior surface is  $3340 \text{ m}^2$ . If the volume of the hall is  $13000 \text{ m}^3$ , find the absorption coefficient. [3]

Or

2. (a) Explain magnetostriction effect. Explain how magnetostriction oscillator is used to produce ultrasonic waves with the help of neat circuit diagram. [6]
- (b) Explain an application of interference Antireflection coating. [3]
- (c) A plane transmission grating has 5000 lines/cm. Find out the highest order spectrum observed if incident light has  $\lambda = 6000 \text{ \AA}$ . [3]

3. (a) What is Double refraction ? Explain Huygens's theory of double refraction. [6]
- (b) What is Holography ? Explain the process of hologram recording. [3]
- (c) Calculate the mobility of charge carriers in doped silicon whose conductivity is  $100/\Omega\text{-m}$  and the Hall coefficient is  $3.6 \times 10^{-4} \text{ m}^3/\text{C}$ . [3]

Or

4. (a) Derive an expression for conductivity in intrinsic and extrinsic Semiconductors. [6]
- (b) Define the following : [3]
- (1) Stimulated Emission
  - (2) Meta-stable state
  - (3) Pumping.

- (c) Plane polarized light passes through a positive double refracting crystal of thickness  $40 \mu\text{m}$  and emerges out as circularly polarized light. If the birefringence of the crystal is  $4 \times 10^{-5}$ , find the wavelength of the incident light. [3]
5. (a) Derive an expression for energy of a particle trapped in an infinite potential well. [6]
- (b) Define phase velocity and group velocity. Derive the relation between them. [4]
- (c) An electron beam is accelerated from rest through a potential difference of  $200 \text{ V}$ . Calculate the associated wavelength. [3]
- Or*
6. (a) What is De-Broglie's hypothesis of matter waves. Show that the De-Broglie's wavelength of a charged particle is inversely proportional to the square root of the accelerating potential. [6]
- (b) Write down the conditions which are to be satisfied by well behaved wave function. [4]
- (c) Calculate the energy required to excite the electron from its ground state to fourth excited state in a rigid box of length  $0.1 \text{ nm}$ . [3]

7. (a) What is superconductivity ? Explain the Meissner effect in superconductors. [6]
- (b) Explain the following properties of Nano-particles : [4]
- (i) Magnetic property
- (ii) Mechanical property.
- (c) Explain the applications of nano particles in medical and automobile field. [3]

*Or*

8. (a) Explain the synthesis of Nano particles by using mechanical method. [6]
- (b) Explain zero electrical resistance property and isotope effect in superconductor. [4]
- (c) Explain any *one* application of superconductors in brief. [3]