

Total No. of Questions—8]

[Total No. of Printed Pages—4

Seat No.	
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[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 neutron =  $m_n = 1.675 \times 10^{-27}$  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]

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- (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  $\mu = 1600 \text{ cm}^2/\text{V.s}$ ] [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  $\psi$ . 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]