

Roll No. ....

## TPH-101

### B. TECH. (FIRST SEMESTER) END SEMESTER EXAMINATION, 2018

#### ENGINEERING PHYSICS

Time : Three Hours

Maximum Marks : 100

Note : (i) This question paper contains two Sections.

(ii) Both Sections are compulsory.

#### Section—A

##### (CS Branch)

1. Fill in the blanks : (1×5=5 Marks)

(a) Fermi energy is proportional to .....

( $n^{2/3}$  or  $1/n^{2/3}$ ).

(no. of electrons' per unit volume)

(b) In band structure of solids the width of the energy bands ..... (increases/decreases) with increasing the energy.

(c) Optical Fibers works on the phenomenon of .....



(2)

TPH-101

(d) Write the expression for energy confined in 1-D box  $E = \dots\dots\dots$

(e) Semiconductors have  $\dots\dots\dots$  (positive/negative) temperature coefficient of resistivity.

2. Attempt any five parts out of seven :

(3×5=15 Marks)

(a) Discuss the dependence of Fermi level on temperature.

(b) Write difference between intrinsic and extrinsic semiconductors.

(c) Write short notes on quantum wire, well and dots.

(d) A sugar solution of certain length causes on optical  $30^\circ$ . How much length of the same solution will cause on optical rotation of  $45^\circ$  rotations ?

(e) Write a short note on Laurent's half shade polarimeter.

(f) Explain Rayleigh criteria of least resolution.

(g) Explain the construction and working of Ruby Laser.

(3)

TPH-101

Section—B

(CS Branch)

3. Attempt any two parts of choice from (a), (b) and (c). (10×2=20 Marks)

(a) Discuss the concept of allowed energy bands in solids using Kronig-Penny model.

(b) Discuss displacement method to determine the distance between two virtual sources formed in Fresnel experiment.

(c) Derive the expression for Fermi energy at 0K.

4. Attempt any two parts of choice from (a), (b) and (c). (10×2=20 Marks)

(a) Derive the Schrödinger Time-dependent and independent wave equations.

(b) Derive the expression for effective mass.

(c) Assuming that there are  $5 \times 10^{28}$  atoms/m<sup>3</sup> in copper, find the Hall coefficient ( $e = 1.6 \times 10^{-19}$  C).

5. Attempt any two parts of choice from (a), (b) and (c). (10×2=20 Marks)

(a) Derive the expression for Fermi level in intrinsic and extrinsic semiconductors.



(4)

TPH-101

- (b) Discuss the production and detection of plane, circularly and elliptically polarized light.
- (c) Find the intrinsic carrier concentration for silicon material at room temperature ( $T = 300 \text{ K}$ ). Given that effective mass of electron  $m_e^* = 1.09 m_0$  and  $m_h^* = 1.15 m_0$  and mass of free electron  $m_0 = 9.1 \times 10^{-31} \text{ kg}$ , Energy band gap for silicon =  $1.12 \text{ eV}$ .

6. Attempt any two parts of choice from (a), (b) and (c). (10×2=20 Marks)

- (a) Derive the expression for diameters of bright and dark rings in Newton's ring experiment.
- (b) Discuss the E-K diagram in semiconductors.
- (c) Derive the expression for the energy levels for a particle confined in one-dimensional box or infinite potential well and establish its wave function.

#### Section—A

(Non-CS Branch)

1. Fill in the blanks/True-False : (1×5=5 Marks)

- (a) Write Einstein mass energy relation.

(5)

TPH-101

- (b) Ratio of  $I_{\min}/I_{\max} = \dots\dots\dots$  in Rayleigh's criterion of resolution.
- (c) Write the expression for diameter of bright ring in Newton's Ring experiment.
- (d) A superconductor is characterized by  $\dots\dots\dots$  (Zero/infinite) electrical resistivity.
- (e) The phenomenon which establishes the transverse nature of light waves is  $\dots\dots\dots$  (interference/polarization)

2. Attempt any five parts out of seven :

(3×5=15 Marks)

- (a) Explain the electrical and magnetic properties of superconductor.
- (b) A sugar solution of certain length causes an optical  $30^\circ$ . How much length of the same solution will cause an optical rotation of  $45^\circ$  rotations ?
- (c) Write Einstein's postulate of special theory of relativity.
- (d) The refractive index of core and cladding are 1.52 and 1.41 respectively. Find the acceptance angle and numerical aperture.
- (e) Explain law of Malus.
- (f) Explain Heisenberg's uncertainty principle.
- (g) Discuss the quarter wave plate and half wave plate.



(6)

TPH-101

## Section—B

- ((Non-CS Branch))

3. Attempt any *two* parts of choice from (a), (b) and (c). (10×2=20 Marks)
- (a) Derive Maxwell's equation and write the significance of each equation.
  - (b) Derive the expression for length contraction.
  - (c) At what velocity will the mass of the body become 3 times its rest mass?
4. Attempt any *two* parts of choice from (a), (b) and (c). (10×2=20 Marks)
- (a) Derive the Schrödinger Time-dependent and independent wave equations.
  - (b) Discuss the production and detection of plane, circularly and elliptically polarized light.
  - (c) An electron of rest mass  $m_0 = 9.1 \times 10^{-31}$  kg moves with the speed  $c/\sqrt{2}$ . Calculate the relativistic mass.
5. Attempt any *two* parts of choice from (a), (b) and (c). (10×2=20 Marks)
- (a) Explain Michelson-Morley experiment and discuss its negative results.

(7)

TPH-101

- (b) Derive the expression for diameters of bright and dark rings in Newton's ring experiment.
  - (c) In a plane transmission grating the angle of diffraction for the second order principal maxima for wavelength 5000 Å is 30°. Calculate the number of lines per cm, of the grating.
6. Attempt any *two* parts of choice from (a), (b) and (c). (10×2=20 Marks)
- (a) Derive the expression for time dilation.
  - (b) Write a short note on Type I and Type II superconductors.
  - (c) Derive the expression for the energy levels for a particle confined in one-dimensional box or infinite potential well and establish its wave function.

TPH-101