Total No. of Questions—8] [Total No. of Printed Pages—4+1

Seat No.	

[5667]-1005

F.E. (First Semester) EXAMINATION, 2019

ENGINEERING PHYSICS

(Phase II)

(2019 PATTERN)

Time : 2½ Hours **Maximum Marks : 70**

N.B. :— (*i*) Solve any *one* question out of Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of electronic calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Derive Schrodinger's time independent wave equation. [6]

(*b*) State the de Broglie hypothesis and explain any *three* properties of matter waves. [4]

(*c*) Explain tunneling effect. Explain in brief how this is used in scanning tunneling microscope. [4]

(*d*) Lowest energy of an electron trapped in potential well is 38 eV. Calculate the width of well in A.V. [Given : Mass of electron 9.1×10^{-31} kg, plank constant 6.63×10^{-34} J-s, charge on e^- 1.6×10^{-19} C]. [4]

P.T.O.

Or

2. (*a*) What is Schrodinger's equation ? Derive Schrodinger's time dependent equation. [6]

(*b*) State and explain Heisenberg's uncertainty principle. [4]

(*c*) What is wave function ψ ? Explain physical significance of $|X|^2$. [4]

(*d*) If uncertainty in position of a particle is equal to its de Broglie wavelength, show that uncertainty in velocity is equal to the velocity of the particle. Consider the product of uncertainties as h. [4]

3. (*a*) Using Fermi Dirac probability distribution function, derive an expression for the position of Fermi energy level in the intrinsic semiconductor. [6]

(*b*) Derive the ideal diode equation for a P-N junction. [4]

(*c*) Calculate the mobility of charge carriers in doped silicon whose conductivity is 100 per Ω.m and the Hall coefficient is 3.6×10^{-4} m^3/c. [4]

(*d*) What is photovoltaic effect ? Draw I V characteristics of solar cell and define fill factor. [3]

Or

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

(*b*) State any *four* measures to improve efficiency of solar cell. [4]

(c) Calculate the conductivity of pure silicon at room temperature when concentration of carriers is 1.6×10^{10} per CC. [Given μ_e = 1500 cm^2/V-sec, μ_h = 500 cm^2/V.sec, charge on electron 1.6×10^{-19} C]. [4]

(d) Explain in brief concept of effective mass of electron. [3]

5. (a) Define superconductivity with resistance *Vs* temperature graph and example. Explain zero electrical resistance in super conductivity. [6]

(b) Explain DC and AC Josephson effect with diagram. [4]

(c) Distinguish between diamagnetism, paramagnetism and ferromagnetism (*two* points each). [4]

(d) Define with unit : [4]

(*i*) Magnetic field strength (H)

(*ii*) Magnetization (M).

Or

6. (a) Explain how information is recorded and retrieved in magneto-optical recording devices. [6]

(b) Explain in brief : [4]

(*i*) Absolute permeability

(*ii*) Relative permeability.

(c) What are SQUID ? Explain any *two* applications of SQUID. [4]

(*d*) The transition temperature of lead is 7.2 K. However, at 5 K it loses the superconducting property if subjected to magnetic field of 3.3×10^4 A/m. Find the maximum value of H which will allow the metal to retain its super conductivity at 0 K. [4]

7. (*a*) What is non-destructive testing ? State types of non-destructive techniques ? Explain ultrasonic testing technique for flaw detection. [6]

(*b*) An ultrasonic pulse is sent through a block of copper. The echo pulse is received after 4 μs. If velocity of ultrasonic in copper is 5000 m/s, calculate the thickness of copper block. If the reflection of pulse is recorded after 1.253 μs from the top, what is the location of flow ? [4]

(*c*) What is nanotechnology ? Explain applications of nanotechnology in electronic field. [4]

(*d*) What is quantum confinement ? How does it affect the properties of nano particles ? [3]

Or

8. (*a*) Explain electrical and mechanical properties of nano-particles. [6]

(*b*) Explain how nanotechnology is employed in targeted drug delivery. [4]

(c) An ultrasonic pulse of frequency 130 kHz is sent through a block of steel. The echo pulse is received after 1.695 μs. If velocity of ultrasonic in steel is 5900 m/s, calculate the thickness of the steel block and wavelength of the pulse. [4]

(d) Explain in brief how acoustic emission technique is used in non-destructive testing. [3]