

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

Seat No.	
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[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 $|\psi|^2$. [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 $\Omega.m$ and the Hall coefficient is $3.6 \times 10^{-4} \text{ m}^3/c$. [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 $\mu_e = 1500 \text{ cm}^2/\text{V}\cdot\text{sec}$, $\mu_h = 500 \text{ cm}^2/\text{V}\cdot\text{sec}$, charge on electron $1.6 \times 10^{-19} \text{ C}$]. [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 μ s. 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 μ s 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 μ s. 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]