AT–326

B.Sc. (Part—II) Semester—III Examination

PHYSICS

Time : Three Hours] [Maximum Marks : 80

Note :— (1) **All** questions are compulsory.

(2) Draw suitable and neat diagram wherever necessary.

1. (A) Fill in the blanks :

(i) In FET, P-N junction between gate and source is _____ biased.

(ii) Magnetic induction is a _____ quantity.

(iii) _____ is the science of earthquakes and related phenomenon.

(iv) The rest mass of photon is _____. 2

(B) Choose correct alternative :

(i) The band gap energy for Ge semiconductor is :

(a) 1.1 eV (b) 0 eV

(c) 0.7 eV (d) 2 eV

(ii) The current amplification factor alpha α_{dc} is given by :

(a) I_e/I_E (b) I_e/I_B

(c) $\frac{I_B}{I_E}$ (d) $\frac{I_B}{I_e}$

(iii) Innermost structural shell of earth is :

(a) Mantle (b) Core

(c) Crust (d) Hydrosphere

(iv) $\overline{\nabla} \cdot \overline{D} = \rho$ is based on :

(a) Ampere's law (b) Faraday's law

(c) Ohm's law (d) Gauss's law 2

(C) Answer in **one** sentence each :

(i) State Lorentz force equation

(ii) What is epicenter of earthquake ?

(iii) Define Common Mode Rejection Ratio (CMRR).

(iv) State Einstein's mass-energy equivalence relation. 4

EITHER

2. (A) State and prove Gauss's Divergence Theorem. 6

(B) State and prove Ampere's Circuital Law. 4

(C) Explain the flux of electric field. 2

OR

3. (P) State and prove Stoke's theorem. 6

(Q) Deduce an expression for magnetic induction due to long solenoid. 6

EITHER

4. (A) State and prove Poynting theorem. 6

(B) State Faraday's law and derive an expression $\overline{\nabla} \times \overline{E} = -\frac{\partial \overline{B}}{\partial t}$. 6

OR

5. (P) Derive Maxwell equation $\overline{\nabla} \times \overline{H} = \overline{J} + \frac{\partial \overline{D}}{\partial t}$. State its equivalent integral form. 6

(Q) Write down Maxwell equations in free space and prove that velocity of plane electromagnetic waves in free space is $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$. 6

EITHER

6. (A) Explain :

(i) Depletion region

(ii) Internal potential barrier. 4

(B) Explain forward and reverse biased characteristics of p-n junction diode. 6

(C) Define 'cut in voltage'. Give the values of 'cut in voltage' for germanium and silicon diode. 2

OR

7. (P) What is doping ? Explain n-type and p-type semiconductor. 6

(Q) What is Hall effect ? 2

(R) Give construction and working of LED. 4

EITHER

8. (A) Explain construction and working of npn transistor. 6

(B) Define α and β of transistor and obtain the relation between them. 4

(C) A given transistor has current gain $\beta = 100$, then find α of a transistor. 2

OR

9. (P) Define :

(i) Input offset voltage

(ii) Slew rate. 2

(Q) Explain construction and working of n-channel JFET. 5

(R) Explain how OP-AMP works as an inverting amplifier, find expression for its voltage gain. 5

EITHER

10. (A) Derive Lorentz transformations. 6

(B) Explain, Time dilation and derive necessary formula. 4

(C) When a 100 cm stick is projected into space its length appears to be contracted to 50 cm, calculate velocity of its projection. 2

OR

11. (P) Derive the relation for the variation of mass with velocity $m = \frac{m_0}{\sqrt{1 - v^2/c^2}}$. 6

(Q) Derive the laws of relativistic addition of velocities. 6

EITHER

12. (A) Describe the structure of earth. 6

(B) What is earthquake ? What are the causes of earthquake ? 6

OR

13. (P) Define :

(i) Focus

(ii) Epicenter. 2

(Q) How clouds are formed ? 4

(R) Explain seismic waves. 2

(S) Explain different layers of atmosphere on the basis of variation in temperature. 4