

2016
PHYSICS
(Theory)

Full Marks : 70

Pass Marks : 21

Time : Three Hours and *Fifteen Minutes

(*15 minutes are given as extra time for reading questions)

Attempt all questions.

The figures in the right margin indicate full marks for the questions.

Question Nos. 1 to 10 are 'Very Short Answer' type questions carrying 1 mark each.

1. Define electric potential at a point. 1
2. What is meant by drift velocity of the free electron ? 1
3. A carbon resistor of $42M\Omega \pm 20\%$ is to be marked with rings of different colours for its identification. Write the sequence of colours. 1
4. What is the value of μ_0 in SI unit ? 1

5. Why alkali metals are most suitable for photoelectric emission? 1
6. Why do α -particles have high ionizing power? 1
7. What is meant by doping? 1
8. What is the full form of LED? 1
9. Draw the symbol for the NOR gate. 1
10. What is broadcast communication? 1

Question Nos. 11 to 20 are 'Short Answer Type-II' questions carrying 2 marks each.

11. A uniformly charged conducting sphere of 0.7 m diameter has a surface charge density of $100\ \mu\text{Cm}^{-2}$. Calculate the charge on the sphere and total electric flux passing through the sphere. 2
12. Show that the electric field is always directed perpendicular to an equipotential surface. 2
13. The length of a conducting wire is 60 m and its radius is 0.5 cm . A potential difference of 5 V produces a current of 2.5 A in the wire. Calculate the resistivity of the material of the wire. 2
14. Give *two* points of difference between the magnetic properties of steel and soft iron. 2

15. No induced e.m.f. is produced in a conductor moving parallel to a magnetic field. Explain why ? 2
16. The Sun looks reddish at Sunrise and Sunset. Give reasons. 2
17. What are isotopes and isotones ? 2
18. Give *any two* points of difference between nuclear fission and nuclear fusion. 2
19. What is space wave propagation ? Give two uses of it in communication system. 1+1=2
20. Write *two* important needs for Modulation. 2

Question Nos. 21 to 27 are 'Short Answer Type-I' questions carrying 3 marks each.

21. Deduce an expression for electrical potential energy of a system of two point charges. 3
22. Give *any two* points of difference between EMF of a cell and potential difference between two points of an electric circuit. 3
23. Write *three* properties of electromagnetic waves. 3

24. Give *three* advantages of reflecting type telescope over refracting type telescope. 3
25. Draw the ray diagrams to show a right-angled prism to turn the rays through
 (i) 90°
 and
 (ii) 180° $1\frac{1}{2} + 1\frac{1}{2} = 3$
26. State the laws of photoelectric emission. 3
27. Explain the working of a transistor as a switch. 3

Question Nos. 28 to 30 are 'Long Answer Type' questions carrying 5 marks each.

28. Derive an expression for the torque experienced on a current carrying rectangular loop kept in a uniform magnetic field. Under what condition is this torque maximum ? 4+1=5

OR

Derive an expression for the torque experienced on a magnetic dipole placed in a uniform magnetic field. Under what condition is this torque maximum ?

4+1=5

29. An alternating e.m.f. $E = E_0 \sin \omega t$ is applied across a pure inductor of inductance L . Show mathematically that the current flowing through it lags behind the applied e.m.f. by a phase angle of $\frac{\pi}{2}$. What is its inductive reactance ? 4+1=5

OR

An alternating e.m.f. $E = E_0 \sin \omega t$ is applied across a pure capacitor of capacitance C . Show mathematically that the current flowing through it leads behind the applied e.m.f. by a phase angle of $\frac{\pi}{2}$. What is its capacitive reactance ? 4+1=5

30. Derive the lens maker's formula in case of a double convex lens. 5

OR

Derive an expression for fringe width using Young's double slit method for interference of light. 5

Question Nos. 31 to 34 are 'Multiple Choice Type' questions carrying 1 mark each. Choose the correct answer out of the four alternatives and rewrite the correct answer.

31. The peak value of a.c. is $2 A$, the effective value of a.c. is 1

(A) 1

(B) $\sqrt{2}$

(C) 2

(D) 0

32. If θ is the polarizing angle, then the refractive index of the materials is

(A) $\sin \theta$

(B) $\cos \theta$

(C) $\tan \theta$

(D) $\cot \theta$

33. Mass is converted into energy according to the relation

(A) $E = mc^2$

(B) $E = mgh$

(C) $E = \frac{1}{2} mc^2$

(D) $E = m/c^2$

34. For determining the light intensity we use

1

(A) a photodiode in reverse bias

(B) a photodiode in forward bias

(C) LED in reverse bias

(D) LED in forward bias