

2018

**PHYSICS**

**(Theory)**

**Full Marks : 70**

**Pass Marks : 21**

**Time : Three hours**

*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.*

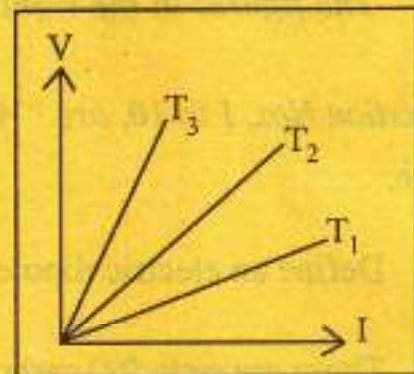
1. Define an electric dipole. 1
2. There are only  $2\Omega$  carbon resistors in stock. A circuit needs  $3\Omega$  resistance. How will you connect the resistors to get the required resistance using minimum numbers? 1
3. What is r.m.s. value of a.c. ? 1
4. Name the part of electromagnetic waves which is used in radiography ? 1
5. What is the effect on the magnifying power of a telescope if the aperture of its objective lens is increased ? 1

6. Light has dual nature. Which nature is supported by photoelectric effect? 1
7. Write *one* drawback of Rutherford's atomic model. 1
8. What is potential barrier in p-n junction diode? 1
9. Write the truth table of two inputs NAND gate. 1
10. Calculate the wavelength of a signal of frequency 10 KHz. 1

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

11. Derive an expression of equivalent capacitance for 2 parallel plate capacitors connected in parallel. 2

12. The figure shows graphs between potential difference ( $V$ ) and current ( $I$ ) of a metallic wire at three different temperatures  $T_1$ ,  $T_2$  and  $T_3$ . Which of them will have the least value of temperature?

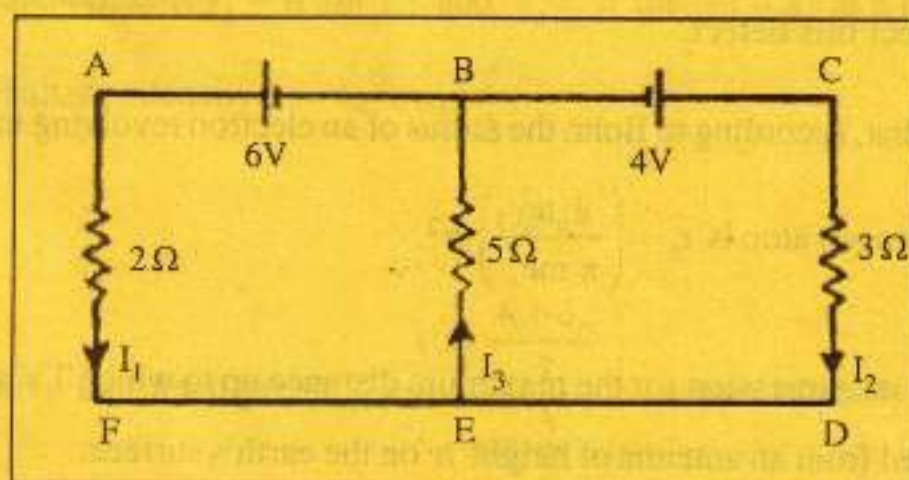


13. An applied e.m.f. signal consists of superposition of a d.c. source and an a.c. source of high frequency. The circuit consists of an inductor  $L$  and a capacitor  $C$  in series. Show that d.c. signal appears across  $C$  and a.c. signal appears across  $L$ . 2
14. Draw a neat labelled diagram of an a.c. generator. 2

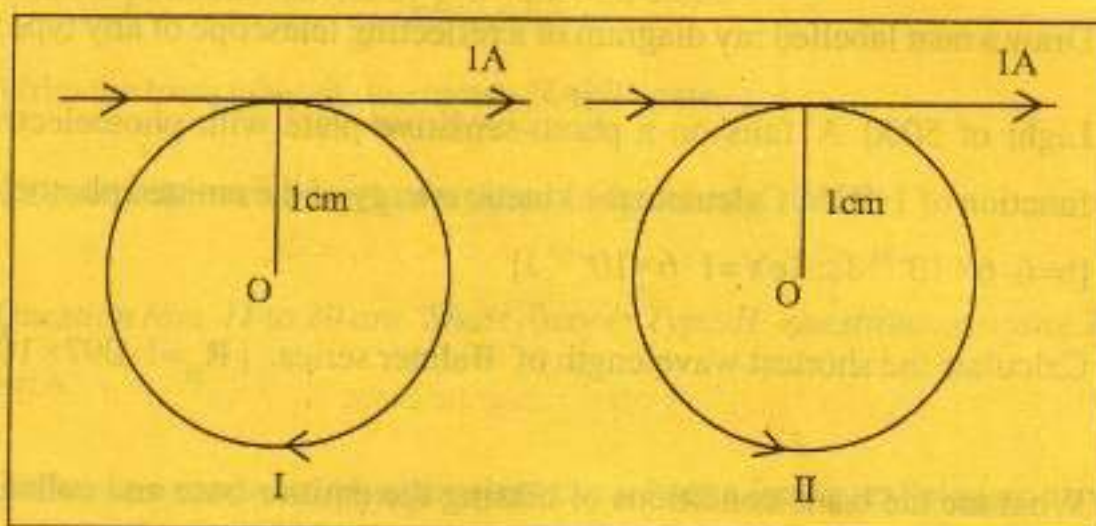
15. Arrange the given *four* electromagnetic waves in ascending order of their wavelengths.
1. Light ray 2.  $\gamma$ -ray 3. Ultraviolet ray 4. X-ray 2
16. Draw a neat labelled ray diagram of a reflecting telescope of any type. 2
17. Light of  $5000 \text{ \AA}$  falls on a photo-sensitive plate with photoelectric work function of  $1.9 \text{ eV}$ . Calculate the kinetic energy of the emitted photoelectrons.  $[\hbar = 6.6 \times 10^{-34} \text{ Js}; 1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}]$  2
18. Calculate the shortest wavelength of Balmer series.  $[R_H = 1.097 \times 10^7 \text{ m}^{-1}]$  2
19. What are the basic conditions of biasing the emitter-base and collector-base junctions of a transistor for its proper functioning? 2
20. Differentiate between n-type and p-type extrinsic semiconductors by giving *two* points. 2

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

21. In the given figure, find the values of  $I_1$ ,  $I_2$ , and  $I_3$  using Kirchoff's law. 3



22. Two similar insulated wires are bent in the form of a circle of radius 1 cm carrying 1 A current each in the direction shown as in fig-I and Fig.-II. Which one will have stronger magnetic field at the centre O ? Justify. 3



23. How does the L-C circuit produce oscillation ? Explain. 3
24. Discuss the difference between a refracting telescope and reflecting telescope by giving *three* points. 3
25. A man suffering from defective vision cannot see objects clearly which is kept within 50cm from his eye. Predict, by calculation, the power of lens required to correct this defect. 3
26. Show that, according to Bohr, the radius of an electron revolving in the  $n^{\text{th}}$  orbit of Hydrogen atom is  $r_n = \left( \frac{\epsilon_0 h^2}{\pi m e^2} \right) n^2$  3
27. Derive an expression for the maximum distance up to which TV signal can be received from an antenna of height  $h$  on the earth's surface. 3

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

28. What is an electric field ? Derive an expression for electric field due to an electric dipole at any point along its equatorial line. 1+4=5

OR

What is electric potential ? Derive an expression for electric potential at a point due to an electric dipole such that the line joining the point from the centre of dipole makes a certain angle from the axis of dipole. 1+4=5

29. What is magnetic dipole moment ? Derive the expression for torque on a bar magnet placed in a uniform magnetic field. 1+4=5

OR

What is a solenoid ? Derive the expression for magnetic field due to a long current carrying solenoid by using Ampere's circuital law. 1+4=5

30. Prove that the superposition of two waves from two coherent sources having displacements  $y_1 = a \sin \omega t$  and  $y_2 = a \sin (\omega t + \phi)$  at a point produce the resultant intensity  $I = 4a^2 \cos^2 \frac{\phi}{2}$ . 5

OR

Prove that for a prism  $\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin \frac{A}{2}}$  where symbols have their usual

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. Potentiometer is preferred to voltmeter to measure e.m.f. of a cell because 1
- A. both draws same current from the source
  - B. potentiometer draws more current than voltmeter from the source
  - C. potentiometer draws less current than voltmeter from the source
  - D. potentiometer draws no current but voltmeter draws current from the source
32. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. If the frequency is halved and intensity is doubled, the photoelectric current becomes 1
- A. quadrupled
  - B. doubled
  - C. halved
  - D. zero
33. For a transistor the emitter current is 0.505 mA and the base current is  $5.0 \mu\text{A}$ . The collector current is 1
- A. 0.25 mA
  - B. 0.5 mA
  - C. 0.52 mA
  - D. 0.55 mA

34. The device fitted in the satellite which receives signals from the earth station and transmits them in the different directions is called 1

A. transmitter

B. amplifier

C. transponder

D. transformer