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 ?


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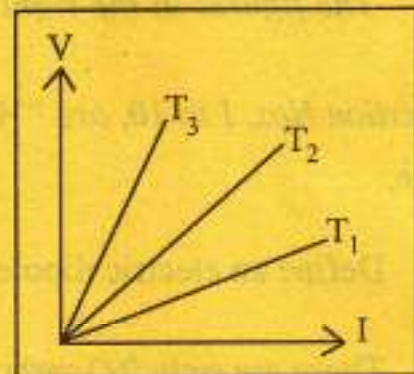
13. An applied e.m.f. signal consists of superposition of a d.c. source and an a.c. source of high frequency. The circuit consists of an inductor L and a capacitor C in series. Show that d.c. signal appears across C and a.c. signal appears across L.   2

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. γ-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 Å falls on a photo-sensitive plate with photoelectric work function of $1 \cdot 9$ eV. Calculate the kinetic energy of the emitted photoelectrons. [$h=6 \cdot 6 \times 10^{-34}$ Js; 1eV$=1 \cdot 6 \times 10^{-19}$ J]   2

18. Calculate the shortest wavelength of Balmer series. [$R_H = 1 \cdot 097 \times 10^7$ 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 Kirchhoff's law.   3
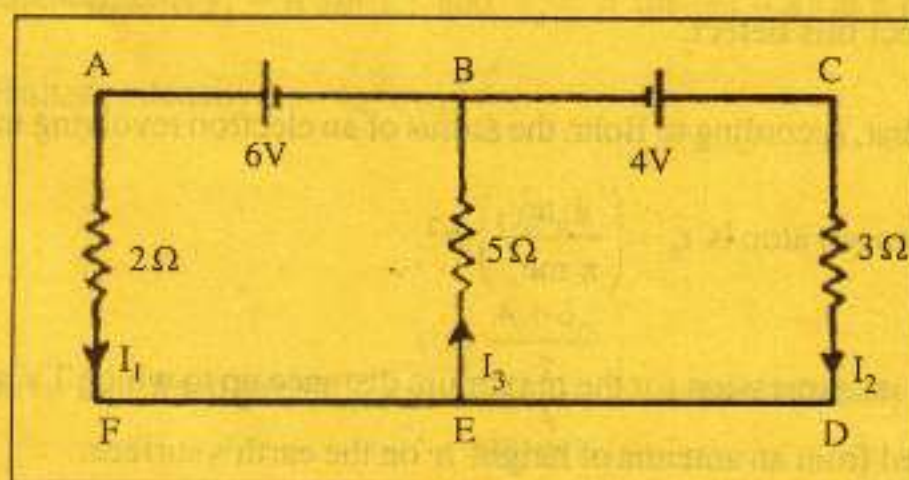
22. Two similar insulated wires are bent in the form of a circle of radius 1cm carrying 1A current each in the direction shown as in fig-I and Fig.-II. Which one will have stronger magnetic field at the centre O ? Justify.   3
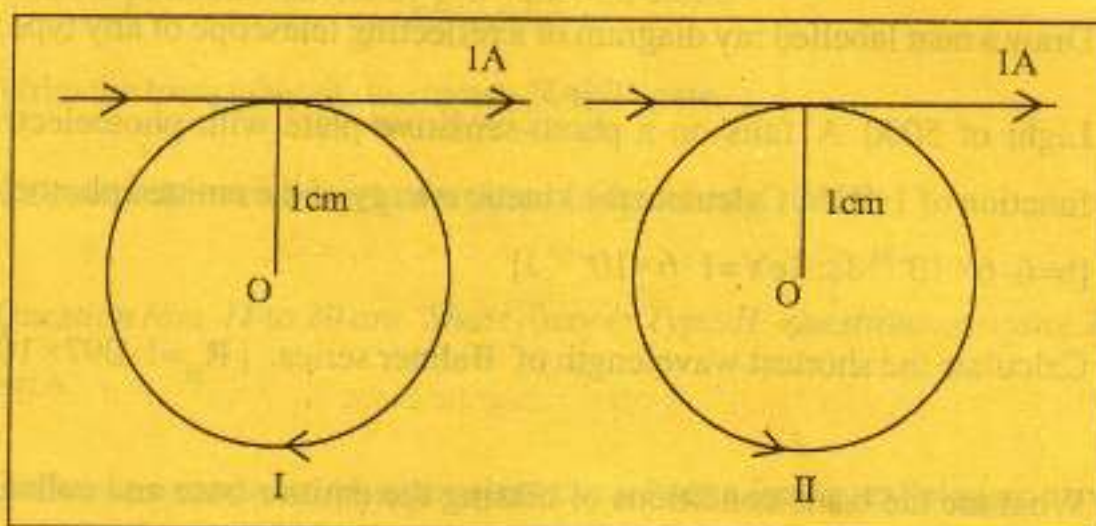
23. How does the L-C circuit produce oscillation ? Explain.   3

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 nth orbit of Hydrogen aton is $r_n = \left(\dfrac{\varepsilon_0 h^2}{\pi m e^2} \right) n^2$ 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 $I = 4a^2 Cos^2 \dfrac{\phi}{2}$. 5

OR

Prove that for a prism $\mu = \dfrac{\sin\left(\dfrac{A + \delta_m}{2}\right)}{\sin\dfrac{A}{2}}$ 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 $1 \cdot 5$ 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 $0 \cdot 505$ mA and the base current is $5 \cdot 0 \ \mu$A. The collector is   1

    A. $0 \cdot 25$ mA

    B. $0 \cdot 5$ mA

    C. $0 \cdot 52$ mA

    D. $0 \cdot 55$ 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