This Question Paper contains 8 Printed Pages.

054(E)

(JULY, 2008)

Time : 3.00 Hours] ***[Maximum Marks : 100***

Instructions :

(1) There are four sections and total **60** questions in this question paper.
(2) All symbols used in this question paper have their usual meanings.
(3) Log table or Simple calculator can be used.
(4) Begin new section on new page. Write answers in sequence.

SECTION-A

*1 to **16** questions are multiple choice type. Each carries **one** mark. Select right answer or choose the correct option.* **16**

1. The Force acting between two point charges kept at a certain distance is F. Now magnitude of charges is doubled and distance between them is halved, the Force acting between them is .....

(A) F (B) $F/2$
(C) 16F (D) 4F

2. A parallel plate capacitor is charged. A dielectric slab is introduced in it. The ..... will remain constant amongst the following options.

(A) Capacitance (B) Charge
(C) Energy (D) Potential difference

3. The rating of our car battery of 12 V is 80 A, which means that 80 A of current will flow, when the battery is connected to a conducting wire. The internal resistance of the battery will be ..... Ω (Ohm).

(A) 0.015 (B) 0.15
(C) 0 (D) 1.5

4. If ..... is stationary, no magnetic force acts on it.

(A) a coil carrying current (B) Magnetic dipole
(B) an electric dipole (D) a straight conductor carrying current

5. Neutral temperature of a thermo-couple is 270°C and temperature of the cold junction is 15°C, then the temperature of inversion is ..... °C.

(A) 285 (B) 255

(C) 525 (D) 575

6. What is magnetisation intensity for vacuum ?

(A) Positive (B) Negative

(C) Zero (D) Infinity

7. A place, where the vertical component of the earth's magnetic field is zero has angle of dip equal to .....

(A) 45° (B) 90°

(C) 0° (D) 60°

8. The power in an AC circuit is given as $P = V_{rms} I_{rms} \cos \delta$. The power factor at the resonance frequency of a series L-C-R circuit will be .....

(A) Zero (B) $1/2$

(C) $1/\sqrt{2}$ (D) 1

9. According to Maxwell, a changing electric field produces .....

(A) Electric current (B) Magnetic field

(C) *emf* (D) Radiation pressure

10. The distance between two slits in Young's experiment is 0.1 mm and the distance of the screen from the slit is 100 cm. If the wave-length of light is 5000 Å, the width of the fringe is .....

(A) 5 mm. (B) 2.5 cm.

(C) 2.5 mm. (D) 5 cm.

11. Focal length of the lens of the eye is changed by .....

(A) Retina (B) Ciliary muscles

(C) Cornea (D) Crystalline lens

12. Mass of Photon in motion is .....

(A) hf (B) h/λ

(C) $\frac{hf}{c^2}$ (D) c/hf

13. The half lifes of α and β decays for a radioactive substance are 4 years and 12 years respectively. After 12 years, its activity will be ..... %.

(A) 6.25 (B) 12.5

(C) 25 (D) 50

14. The emitter junction of the CE transistor amplifier is ..... biased, while the collector junction is ..... biased.

(A) Reverse, Forward (B) Forward, Reverse

(C) Reverse, Reverse (D) Forward, Forward

15. What is the minimum number of geo-stationary satellites needed to establish communication over the entire surface of the earth?

(A) 3 (B) 2

(C) 4 (D) 6

16. The propagation of UHF band is via .....

(A) Sky wave (B) Space wave

(C) Ground wave (D) Optical fibre.

SECTION-B

*Question No. **17** to **32** are very short answer type. Each carries **1** mark.* **16**

17. Write the dimensional formula of Electric Potential.

18. Define Electric Susceptibility.

OR

Write any one use of Van-de-Graaff Generator.

19. Write Ohm's law.

20. What is Missner effect?

21. What is Thermo electric power?

22. State one limitation of Cyclotron.

OR

State the principle of a Galvanometer.

23. What is called a Permanent magnet?

24. Draw the circuit symbol of an Inductor.

25. Name the electro-magnetic wave, which is used in Communication.

26. If for given medium, Critical angle is 30°, find the refractive index of the medium.

OR

If power of lens is +2.0 D, then what will be the focal length of the Convex lens.

27. Write the condition of destructive interference in terms of path difference.

28. Draw the plane of vibration and plane of polarization in one figure.

OR

Give two definitions of Diffraction.

29. Write the formula of momentum for a Photon having frequency *f*.

30. Name the spectral series which lies in ultra-violet region of hydrogen spectra.

31. Write the boolean expression for the NOR gate.

32. What is Remote Sensing?

OR

What is Up Link and Down Link?

SECTION - C

*Question No.**33** to **48** are short answer type. Each carries **2** marks.* **32**

33. Write four characteristics of electric field lines.

OR

Derive formula of energy stored in a charged capacitor.

34. Write Kirchhoff's First law and derive it.

35. With necessary circuit diagram, explain charging process of Lead Storage Cell.

36. Write Biot Savart's law and explain it.

37. Using Ampere's circuital law, derive the formula of magnetic field due to very long conductor carrying electric current. Draw necessary figure.

38. What is Motional *emf*? Derive formula for motional *emf*.

39. In an A.C. circuit; L, C and R are connected in series. Derive formula for Power $P=V_{rms}\, I_{rms} \cos\delta$ in such a circuit.

OR

In a circuit; L, C and R are connected in series and A.C. voltage is applied. Derive the differential equation of charge Q in such a circuit.

40. Explain inductive components and radiated components with necessary diagram.

41. Derive the formula of Lateral magnification for a Concave mirror.

42. Write and explain Huygen's principle with one example.

OR

Explain first order minimum in Fraunhoffer diffraction and obtain condition for it.

43. Explain π and σ components in polarization by reflection. Write Brewster's law.

44. Write any four characteristics of a Photon.

45. Write Bohr's First Hypothesis. Derive formula of radius of nth orbit

$r = \dfrac{n^2 h^2 \varepsilon_0}{\pi Z e^2 m}$ of an electron.

OR

Write four limitations of Bohr model.

46. Name the unit of mass and energy in atomic and nuclear physics and define them.

47. Explain Half Wave Rectification with necessary circuit diagram and graph.

48. Explain Analog and Digital Communication.

SECTION-D

Question Nos. ***49*** *to* ***60*** *are calculative type. Each carries* ***3*** *marks.* **36**

49. A charge of 4×10^{-8} C is uniformly distributed all over the surface of a sphere of radius 1 cm. Another hollow sphere of radius 5 cm is concentric with smaller sphere. Find intensity of electric field at a distance of 2 cm from the centre.

    $K = 9\times10^{9}$ SI.

50. A 900 pF capacitor is charged with the help of 100 V battery. Calculate the steady electric energy on this capacitor. The above capacitor is disconnected from the battery and is connected to another identical capacitor. What will be the total energy of the system?

    OR

    $q_1 = 2\mu C$ electric charge is placed at origin of Cartesian Co-ordinate System. Another $q_2 = -3\mu C$ charge is placed on the X-axis at a distance $x = 100$ cm. At which points along the X-axis, will be the electric potential equal to zero?

51. An *emf* of 412.5 μV is developed in a Fe-Cd thermo-couple when its cold junction is at 0°C and hot junction at 30°C. When hot junction is kept at 100°C, 1200μV *emf* is produced, then find constants α and β of thermo-couple.

52. A toroidal core with 3000 turns has inner and outer radii of 11 cm. and 12 cm. respectively. When a current of 0.70 A is passed, then the magnetic field produced in the core is 2.5 T. Find the relative permeability of the core.

    ($\mu_0 = 4\pi \times 10^{-7}$ Tm A^{-1}).

53. A conducting bar of 2 m length is allowed to fall freely from a 50 m high tower, keeping it aligned along the east-west direction. Find the *emf* induced in the rod, when it is 20 m below from the top of the tower.

$g = 10 ms^{-2}$, Horizontal component of earth's magnetic field is 0.7×10^{-4} T and angle of Dip = 60°.

54. An A.C. source of 230 V is connected in series with 5 H inductor, 80 μ F capacitor and a 40 Ω resistor.

(i) Find resonant frequency (f_0).

(ii) Find the impedence of the circuit and the value of the current at resonant frequency.

OR

L and R are connected in series with an AC voltage. The maximum value of the AC voltage is equal to 220 V. Calculate the power consumed in the circuit as well as the power factor. The reactance of the coil is equal to 40 Ω and R = 30 Ω.

55. When a linear object is placed in front of a convex mirror, image of the $\frac{1}{4}$th size of the object is formed. Calculate the object distance and the image distance. This linear object is kept perpendicular to the axis.

OR

In Young's experiment, a beam of light of wave-length 6500 Å and 5200 Å is used. Find the maximum distance from the central bright fringe, where bright fringes produced by both the wave-length get super-posed. The distance between the two slits is 0.5 mm and the distance between the slits and screen is 100 cm.

56. Ultra-violet light of wave-length 200 nm is incident on polished surface of Fe. Work Function of the surface is 4.7 *e*V.

Find :-

(i) Stopping Potential;

(ii) Maximum Kinetic energy of Photo electrons.

($h = 6.6 \times 10^{-34}$ J.sec., $C = 3 \times 10^8$ ms^{-1}, $1\,eV = 1.6 \times 10^{-19}$ J.,

$m = 9.1 \times 10^{-31}$ Kg.)

57. At a specific time, the rate of radioactive decay of a substance is 8000 decay s^{-1}. At that time the undecayed number of nuclei is 8×10^7. Find the decay constant and the half life.

58. In a X-ray tube, the potential difference between the anode and cathode is 12.4 KV and current flowing is 2 mA. Find :

(i) the number of electrons striking the anode in 1 sec.

(ii) the speed of electrons while striking the anode.

(iii) Minimum wave-length (λ min) emitted.

OR

Calculate the maximum wave-length of Balmer series in the Hydrogen spectrum. Calculate the corresponding wave number.

Rydberg constant : $R = 1.097 \times 10^7 m^{-1}$.

59. The base current changes by 200 μA, when a 200 *m*V signal is applied at the input of a CE amplifier. If the output voltage is equal to 2 volt, what is the voltage gain?

60. The current gain of a common base circuit is equal to α and the current gain of a common emitter (CE) circuit is equal to β. Find the relationship between α and β.

$\beta = \frac{\alpha}{1-\alpha}$ and $\alpha = \frac{\beta}{1+\beta}$.