Question Paper Sl. No. 3590 **4327**

Register Number | | | | | | |

Part III — PHYSICS

(English Version)

Time Allowed : 3 Hours] [Maximum Marks : 150

PART – I

N. B. : i) Answer *all* the questions.

ii) Choose and write the correct answer.

iii) Each question carries *one* mark. 30 × 1 = 30

1. At the threshold frequency, the velocity of the electrons is

   a) zero
   b) maximum
   c) minimum
   d) infinite.

2. In β-decay

   a) atomic number decreases by one
   b) mass number decreases by one
   c) proton number remains the same
   d) neutron number decreases by one.

3. The fuel used in Kamini (Kalpakkam mini reactor) is

   a) mixture of carbides of uranium and plutonium
   b) mixture of oxides of plutonium and uranium
   c) $_{92}U^{233}$
   d) $_{92}U^{235}$.

4. The nuclear force existing between any two nucleons is due to the continuous exchange of particles called

a) leptons b) mesons

c) hyperons d) photons.

5. The radioisotope used in agriculture is

a) $_{15}P^{32}$ b) $_{11}Na^{23}$

c) $_{15}P^{31}$ d) $_{11}Na^{24}$.

6. In LCR series circuit, at resonance

a) impedance (Z) is maximum b) current is minimum

c) impedance (Z) is equal to R d) $\gamma_0 = \frac{1}{\sqrt{LC}}$.

7. Electromagnetic waves are

a) transverse

b) longitudinal

c) may be longitudinal or transverse

d) neither longitudinal nor transverse.

8. In Newton's ring experiment, the radii of m^{th} and $(m + 4)^{th}$ dark rings are respectively $\sqrt{5}$ mm and $\sqrt{7}$ mm. What is the value of m ?

a) 2 b) 4

c) 8 d) 10.

9. Atomic spectrum should be

a) pure line spectrum b) emission band spectrum

c) absorption line spectrum d) absorption band spectrum.

10. Which of the following is not an optically active material ?

a) Quartz b) Sugar crystals

c) Turpentine oil d) Calcium chloride.

11. When a point charge of 6 μC is moved between two points in an electric field, the work done is $1{\cdot}8 \times 10^{-5}$ J. The potential difference between the two points is

a) 1·08 V b) 1·08 μV

c) 3 V d) 30 V.

12. The electric field outside the plates of two oppositely charged plane sheets of charge density σ is

a) $\frac{\sigma}{2\varepsilon_0}$ b) $-\frac{\sigma}{2\varepsilon_0}$

c) $\frac{\sigma}{\varepsilon_0}$ d) zero.

13. Torque on a dipole in a uniform electric field is maximum when the angle between $\vec{p}$ and $\vec{E}$ is

a) 0° b) 45°

c) 90° d) 180°.

14. The equivalent capacitance of two capacitors connected in series is 1·5 μF. The capacitance of one of them is 4 μF. The capacitance of the other is

a) 2·4 μF b) 2 μF

c) 4 μF d) 6 μF.

15. If the length of a copper wire has a certain resistance R, then on doubling the length, its specific resistance

a) will be doubled b) will become $\frac{1}{4}$ th

c) will become 4 times d) will remain the same.

16. The Boolean expression to represent NAND operation is

a) $Y = A + B$ b) $Y = A \cdot B$

c) $Y = \overline{A}$ d) $Y = \overline{AB}$.

17. In single stage CE amplifier, the voltage gain at mid-frequency is 10. The voltage gain at upper cut-off frequency is

a) 10 b) 10·1

c) 7·07 d) 14·14.

18. Barkhausen condition for maintenance of oscillations in oscillator is

a) $\beta = \frac{1}{A}$ b) $A\beta = \alpha$

c) $A = \beta$ d) $A\beta = \frac{1}{\sqrt{2}}$.

19. In Televison, blanking pulse is applied to

a) horizontal deflector plates b) vertical deflector plates

c) control grid d) filament.

20. Digital signals are converted into analog signals using

a) fax b) modem

c) cable d) co-axial cable.

21. In hydrogen atom, which of the following transitions produces a spectral line of maximum wavelength ?

a) $2 \rightarrow 1$ b) $4 \rightarrow 1$

c) $6 \rightarrow 5$ d) $5 \rightarrow 2$.

22. According to Bohr's postulates, which of the following quantities takes discrete values ?

a) Kinetic energy b) Potential energy

c) Angular momentum d) Momentum.

23. In holography, which of the following is (are) recorded on the photographic film ?

a) Frequency and Amplitude b) Phase and Frequency

c) Phase and Amplitude d) Frequency only.

24. The direction of viscous force in Millikan's oil drop experiment is

a) always downwards

b) always upwards

c) opposite to the direction of motion of the oil drop

d) either upwards or downwards.

25. The wavelength of matter waves is independent of

a) mass b) velocity

c) momentum d) charge.

26. Phosphor-bronze wire is used for suspension in a moving coil galvanometer, because it has

a) high conductivity b) high resistivity

c) large couple per unit twist d) small couple per unit twist.

27. Unit of Peltier coefficient is

a) ohm b) mho

c) volt d) ampere.

28. An e.m.f. of 12 V is induced when the current in the coil changes at the rate of 40 As^{-1}. The coefficient of self-induction of the coil is

a) 0·3 H b) 0·003 H

c) 30 H d) 4·8 H.

29. Which of the following cannot be stepped up in a transformer ?

a) Input current b) Input voltage

c) Input power d) All of these.

30. The core used in audio frequency chokes is

a) iron b) carbon

c) lead d) air.

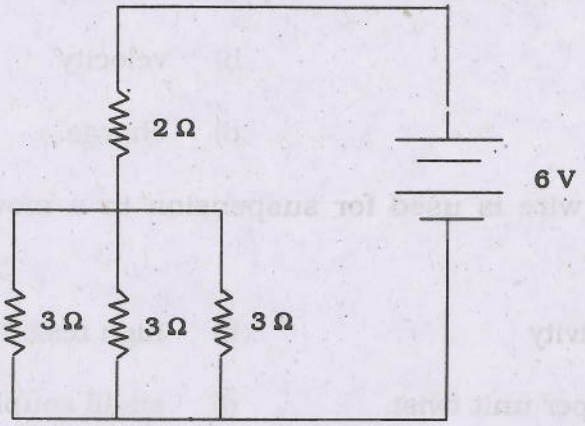
PART – II

N. B. : Answer any *fifteen* questions. $15 \times 3 = 45$

31. What is an electric dipole ? Define electric dipole moment.

32. What is meant by dielectric polarisation ?

33. In the given circuit, what are the total resistance and current supplied by the battery ?



34. State Ohm's law.

35. Define drift velocity.

36. How can we increase the current sensitivity of a galvanometer ?

37. State Fleming's right hand rule.

38. What is meant by r.m.s. (effective) value of alternating current ?

39. The refractive index of a medium is $\sqrt{3}$. Calculate the angle of refraction if the unpolarised light is incident on it at the polarising angle of the medium.

40. State Huygens' principle.

41. Calculate the short wavelength limit of Lyman Series ($R = 1{\cdot}097 \times 10^{7}\ m^{-1}$).

42. What are the applications of laser in medical field ?

43. Define stopping potential.

44. What is binding energy of nucleus ?

45. The half-life of Radon is 3·8 days. Calculate its mean life.

46. Write the different methods of doping a semiconductor.

47. What is a Zener diode ? Draw its symbol.

48. Define output impedance of a transistor.

49. When negative feedback is applied to an amplifier of gain 50, the gain after feedback falls to 25. Calculate the feedback ratio.

50. Define modulation factor.

PART – III

N. B. : i) Answer Question No. **54** compulsorily.

ii) Answer any *six* of the remaining 11 questions,

iii) Draw diagrams wherever necessary. $7 \times 5 = 35$

51. What is electrostatic potential energy of a system of two point charges ? Deduce an expression for it.

52. Explain the determination of the internal resistance of a cell using voltmeter.

53. State Faraday's first law of electrolysis. How is it verified experimentally ?

54. a) Two parallel wires each of length 5 m are placed at a distance of 10 cm apart in air. They carry equal currents along the same direction and experience a mutually attractive force of $3{\cdot}6 \times 10^{-4}$ N. Find the current through the conductors.

OR

b) A rectangular coil of 500 turns and of area 6×10^{-4} m^2 is suspended inside a radial magnetic field of induction 10^{-4} T by a suspension wire of torsional constant 5×10^{-10} Nm per degree. Calculate the current required to produce a deflection of 10°.

55. Explain the various energy losses in a transformer. How are they minimised ?

56. Write a note on Nicol prism.

57. Obtain Bragg's law.

58. Derive Einstein's photoelectric equation.

59. A metallic surface when illuminated with light of wavelength 3333 Å emits electrons with energies upto 0·6 eV. Calculate the work function of the metal.

60. A reactor is developing energy at the rate of 32 MW. Calculate the required number of fissions per second of $_{92}U^{235}$. Assume that energy per fission is 200 MeV.

61. State and prove de Morgan's theorems.

62. Explain the function of FM transmitter with a neat block diagram.

PART – IV

N. B. : i) Answer any *four* questions in detail.

ii) Draw diagrams wherever necessary. $4 \times 10 = 40$

63. State the principle and explain the construction and working of van de Graaff generator.

64. Obtain an expression for the magnetic induction at a point due to an infinitely long straight conductor carrying current.

65. Discuss with theory the method of inducing e.m.f. in a coil by changing its orientation with respect to the direction of the magnetic field.

66. Explain the theory of interference in thin transparent film due to reflected light and obtain the condition for the intensity to be maximum and minimum.

67. Describe the J. J. Thomson method for determining the specific charge of electron.

68. Write the radioactive law of disintegration. Obtain an expression to deduce the amount of radioactive substance present at any moment. Obtain the relation between half-life period and decay constant.

69. What is an operational amplifier ? Explain its action as (i) inverting amplifier, (ii) non-inverting amplifier.

70. Explain the functions of various units in the monochrome television transmission with suitable block diagram.