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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. Barkhausen condition for maintenance of oscillation is

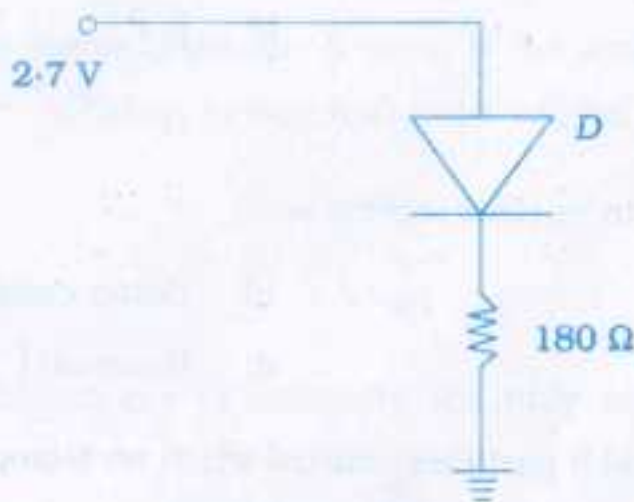
a) $\beta = \frac{1}{A}$

b) $A\beta = \infty$

c) $A = \beta$

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

2. Find the voltage across the resistor as shown in the figure (silicon diode is used).



a) 2.4 V

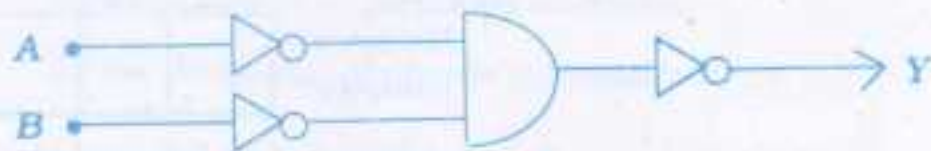
b) 2.0 V

c) 1.8 V

d) 0.7 V.

[Turn over

3. The output (Y) of the logic circuit given below is



a) $A + B$
c) $\overline{A + B}$

b) $A \cdot B$
d) $\overline{A} + \overline{B}$

4. Digital signals are converted into analog signals using

a) FAX
c) cable

b) modem
d) coaxial cable.

5. The RF channel in a radio transmitter produces

a) audio signals

b) high frequency carrier waves

c) both audio signal and high frequency carrier waves

d) low frequency carrier waves.

6. The work function of a metal is 6.626×10^{-19} J. The threshold frequency is

a) 1×10^{15} Hz

b) 10×10^{-19} Hz

c) 1×10^{-15} Hz

d) 10×10^{19} Hz.

7. Anaemia can be diagnosed by



8. The moderator used in nuclear reactor is

a) Cadmium

b) Boron carbide

c) Heavy water

d) Uranium (${}_{92}\text{U}^{235}$).

9. The numbers of α and β particles emitted when an isotope ${}_{92}\text{U}^{238}$ undergoes α and β decays to form ${}_{82}\text{Pb}^{206}$ are respectively

a) 6, 8

b) 4, 3

c) 8, 6

d) 3, 4.

10. The nuclei ${}_{13}\text{Al}^{27}$ and ${}_{14}\text{Si}^{28}$ are examples of
- isotopes
 - isobars
 - isotones
 - isomers.
11. If a and b are semi-major and semi-minor axes of the ellipse respectively and l is the orbital quantum number, then the expression to find the possible elliptical orbits is
- $\frac{b}{a} = \frac{l+1}{n}$
 - $\frac{b}{a} = \frac{l-1}{n}$
 - $\frac{a}{b} = \frac{l+1}{n}$
 - $\frac{a}{b} = \frac{l-1}{n}$
12. X-ray is
- phenomenon of conversion of kinetic energy into radiation
 - conversion of momentum
 - conversion of mass into energy
 - conversion of light energy into heat energy.
13. According to Bohr's postulates, which of the following quantities take discrete values ?
- Kinetic energy
 - Potential energy
 - Angular momentum
 - Momentum.
14. A crystal diffracts monochromatic X-rays. If the angle of diffraction for the second order is 90° , then that for the first order will be
- 60°
 - 45°
 - 30°
 - 15° .
15. According to special theory of relativity the only constant in all frames of reference is
- mass
 - length
 - time
 - velocity of light.

16. In LCR circuit when $X_L = X_C$, the current
- a) is zero
 - b) is in phase with the voltage
 - c) leads the voltage
 - d) lags behind the voltage.
17. The radiations used in physiotherapy are
- a) ultraviolet
 - b) infrared
 - c) radiowaves
 - d) microwaves.
18. In Newton's rings experiment, light of wavelength 5890 \AA is used. The order of the dark ring produced where the thickness of the air film is 0.589 \mu m is
- a) 2
 - b) 3
 - c) 4
 - d) 5.
19. Atomic spectrum should be
- a) pure line spectrum
 - b) emission band spectrum
 - c) absorption line spectrum
 - d) absorption band spectrum.
20. Of the following, optically active material is
- a) sodium chloride
 - b) calcium chloride
 - c) sodium
 - d) chlorine.
21. Peltier effect is the converse of
- a) Joule effect
 - b) Raman effect
 - c) Thomson effect
 - d) Seebeck effect.
22. The torque experienced by a rectangular current loop placed perpendicular to a uniform magnetic field is
- a) maximum
 - b) zero
 - c) finite minimum
 - d) infinity.
23. Transformer works on
- a) both AC and DC
 - b) AC more effectively than DC
 - c) AC only
 - d) DC only.

24. Lenz's law is in accordance with the law of
- conservation of energy
 - conservation of charge
 - conservation of momentum
 - conservation of angular momentum.
25. The self-inductance of a straight conductor is
- zero
 - infinity
 - very large
 - very small.
26. A dipole is placed in a uniform electric field with its axis parallel to the field. It experiences
- only a net force
 - only a torque
 - neither a net force nor a torque
 - both a net force and a torque.
27. The unit of electric dipole moment is
- volt / metre $\left(\frac{V}{m}\right)$
 - Coulomb / metre $\left(\frac{C}{m}\right)$
 - volt. metre (Vm)
 - Coulomb. metre (Cm).
28. Electric potential energy of an electric dipole in an electric field is given as
- $pE \sin \theta$
 - $-pE \sin \theta$
 - $-pE \cos \theta$
 - $pE \cos \theta$.
29. Electric field intensity is 400 V/m at a distance of 2 m from a point charge. It will be 100 V/m at a distance of
- 50 cm
 - 4 cm
 - 4 m
 - 1.5 m.
30. The brown ring at one end of a carbon resistor indicates a tolerance of
- 1%
 - 2%
 - 5%
 - 10%.

PART - II

N. B. : Answer any fifteen questions.

15 × 3 = 45

31. Define electric potential at a point.
32. What is a polar molecule ? Give any two examples.
33. State Kirchhoff's voltage law.
34. Define drift velocity.
35. The resistance of a platinum wire at 0°C is 4 Ω . What will be the resistance of the wire at 100°C if the temperature coefficient of resistance of platinum is 0.0038/°C ?
36. In a galvanometer, increasing the current sensitivity does not necessarily increase the voltage sensitivity. Explain.
37. State Fleming's right hand rule.
38. A coil of area of cross-section 0.5 m² with 10 turns is in a plane perpendicular to a uniform magnetic field of 0.2 Wb/m². Calculate the flux through the coil.
39. What is Tyndall scattering ?
40. In Newton's rings experiment the diameter of certain order of dark ring is measured to be double that of second ring. What is the order of the ring ?
41. State Moseley's law.
42. Define ionisation potential.
43. Mention the uses of electron microscope.
44. What is meant by pair production and annihilation ?
45. The half-life of radon is 3.8 days. Calculate its mean life.
46. What is rectification ?
47. What is a light emitting diode ? Give any one of its uses.
48. Define bandwidth of an amplifier.
49. When there is no feedback the gain of the amplifier is 100. If 5% of the output voltage is fed back into the input through a negative feedback network, find out the voltage gain after feedback.
50. What are the advantages of digital communication ?

PART - III

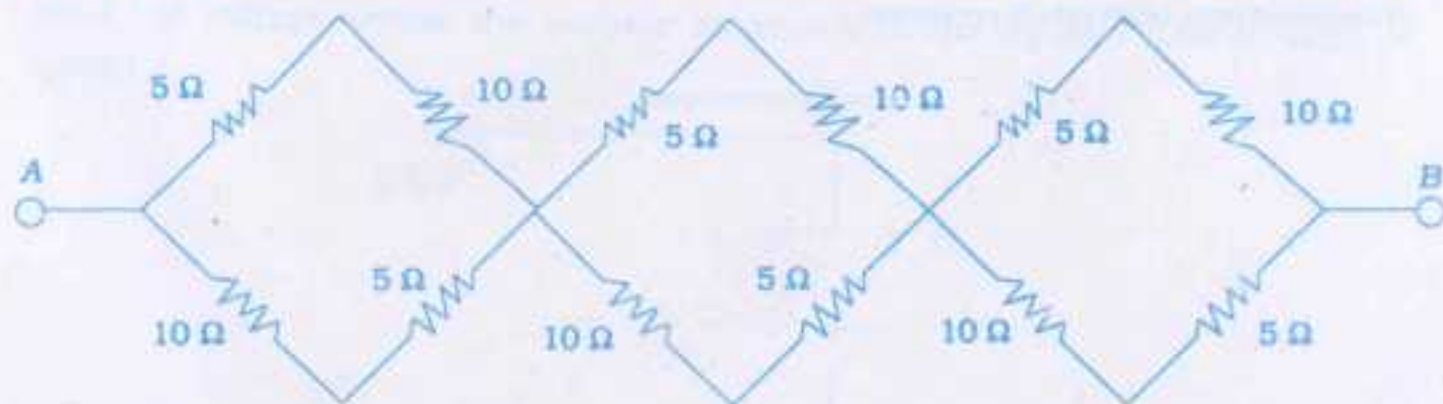
N.B. : i) Answer Question No. 60 compulsorily.

ii) Answer any six of the remaining 11 questions,

iii) Draw diagrams wherever necessary.

7 × 5 = 35

51. Write the properties of lines of forces.
52. How will you compare the *e.m.f.s* of two cells using a potentiometer ?
53. A moving coil galvanometer of resistance $20\ \Omega$ produces full scale deflection for a current of $50\ \text{mA}$. How will you convert the galvanometer into (i) an ammeter of range $20\ \text{A}$ and (ii) a voltmeter of range $120\ \text{volt}$?
54. Give the applications of eddy currents.
55. Write a note on Nicol prism.
56. Wavelength of Balmer Second line is $4861\ \text{\AA}$. Calculate the wavelength of the first line.
57. Derive an expression for de Broglie wavelength of matter waves.
58. Define work function. State the laws of photo-electric emission.
59. Explain how a cosmic ray shower is formed.
60. In the given network, calculate the effective resistance between points A & B.



OR

The effective resistances are $10\ \Omega$, $2.4\ \Omega$ when they are connected in series and parallel respectively. What are the resistances of individual resistors ?

61. With the circuit diagram, explain voltage divider biasing of a transistor.
62. Mention the principle of RADAR and write its applications.

PART - IV

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

ii) Draw diagrams wherever necessary.

4.
 $4 \times 10 = 40$

63. Derive an expression for electric field due to an electric dipole at a point along the equatorial line.
64. Explain in detail the principle, construction, working and limitations of a cyclotron with a diagram.
65. Describe the principle, construction and working of a single phase a.c. generator.
66. Explain Raman scattering of light with the help of energy level diagram.
67. How will you determine the wavelength of X-rays using Bragg spectrometer ?
Write any five properties of X-rays.
68. Explain the construction and working of a GM (Geiger-Müller) counter.
69. With circuit diagram, explain the working of an operational amplifier as a summing amplifier.
70. With the help of a block diagram, explain the functions of various units in the monochrome television receiver.
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