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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. Einstein's photoelectric equation is

a) $W + h\nu = \frac{1}{2}mv_{max}^2$

b) $\frac{1}{2}mv_{max}^2 = W$

c) $h\nu + \frac{1}{2}mv_{max}^2 = W$

d) $W + \frac{1}{2}mv_{max}^2 = h\nu.$

2. The explosion of atom bomb is based on the principle of

a) uncontrolled fission reaction

b) controlled fission reaction

c) fusion reaction

d) thermonuclear reaction.

3. Anaemia can be diagnosed by

a) ${}_{15}\text{P}^{31}$ b) ${}_{15}\text{P}^{32}$ c) ${}_{26}\text{Fe}^{59}$ d) ${}_{11}\text{Na}^{24}.$

4. The mean life of radon is 5.5 days. Its half-life is

a) 8 days

b) 2.8 days

c) 0.38 days

d) 3.8 days.

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5. The energy equivalent to 1 amu is
- 931 MeV
 - 931 meV
 - 931 eV
 - 913 MeV.
6. The angle between the area vector \vec{A} and the plane of the area A is
- $\frac{\pi}{2}$
 - π
 - 2π
 - zero.
7. In an electromagnetic wave
- power is equally transferred along the electric and magnetic fields
 - power is transmitted in a direction perpendicular to both the fields
 - power is transmitted along electric field
 - power is transmitted along magnetic field.
8. In the grating formula $\sin \theta = Nm \lambda$, the unit of N is
- metre
 - metre⁻¹
 - no unit
 - (metre)².
9. If the wavelength of the light is reduced to one fourth, then the amount of scattering is
- increased by 16 times
 - decreased by 16 times
 - increased by 256 times
 - decreased by 256 times.
10. The ratio of the radii of the 4th and 9th dark rings in Newton's rings experiment is
- 4 : 9
 - 2 : 3
 - 16 : 81
 - $\sqrt{2} : \sqrt{3}$.
11. The torque (τ) experienced by an electric dipole placed in a uniform electric field (E) at an angle θ with the field is
- $PE \cos \theta$
 - $-PE \cos \theta$
 - $PE \sin \theta$
 - $2PE \sin \theta$.

12. The unit of electric flux is

- a) $C^2 N^{-1} m^2$ b) $Nm^2 C^{-1}$
 c) $C^2 N^{-1} m^{-2}$ d) $NC^{-1} m^{-2}$.

13. The capacitance of a parallel plate capacitor increases from $5 \mu F$ to $50 \mu F$ when a dielectric is filled between the plates. The permittivity of the dielectric is

- a) $8.854 \times 10^{-12} C^2 N^{-1} m^{-2}$ b) $8.854 \times 10^{-11} C^2 N^{-1} m^{-2}$
 c) 12 d) 10.

14. The negative gradient of potential is

- a) electric force b) torque
 c) electric current d) electric field intensity.

15. The transition temperature of mercury is

- a) $4.2^\circ C$ b) 4.2 K
 c) $2.4^\circ C$ d) 2.4 K.

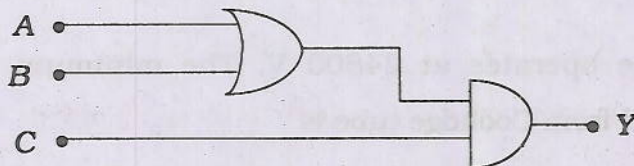
16. An oscillator is

- a) an amplifier with feedback b) a converter of a.c. to d.c. energy
 c) nothing but an amplifier d) an amplifier without feedback.

17. The reverse saturation current in a PN junction diode is only due to

- a) minority carriers b) majority carriers
 c) acceptor ions d) donor ions.

18. If output Y of the following circuit is one (1), the inputs ABC must be



- a) 010 b) 100
 c) 101 d) 110.

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19. Printed documents to be transmitted by fax are converted into electrical signals by the process of
- reflection
 - scanning
 - modulation
 - light variation.
20. In the AM superheterodyne receiver system the value of the intermediate frequency is equal to
- 445 kHz
 - 455 kHz
 - 485 kHz
 - 465 kHz.
21. X-ray is
- phenomenon of conversion of kinetic energy into radiation
 - conversion of momentum
 - conversion of energy into mass
 - principle of conservation of charge.
22. The value of Rydberg's constant is
- $1.094 \times 10^{-7} \text{ m}^{-1}$
 - $1.094 \times 10^{-7} \text{ m}^{-1}$
 - $1.094 \times 10^7 \text{ m}^{-1}$
 - $1.094 \times 10^7 \text{ m}^{-1}$.
23. When an electric field is applied to an atom each of the spectral lines split into several lines. This effect is known as
- Zeeman effect
 - Stark effect
 - Raman effect
 - Seebeck effect.
24. A Coolidge tube operates at 24800 V. The minimum wavelength of X-ray radiation emitted from Coolidge tube is
- $6 \times 10^{18} \text{ m}$
 - $3 \times 10^{18} \text{ m}$
 - $0.6 \times 10^{-10} \text{ m}$
 - $0.5 \times 10^{-10} \text{ m}$.

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25. According to relativity the length of a rod in motion
- is same as its rest length
 - is more than its rest length.
 - is less than its rest length
 - may be more or less than or equal to rest length depending on the speed of the rod.
26. Peltier coefficient at a junction of a thermocouple depends on
- the current in the thermocouple
 - the time for which current flows
 - the temperature of the junction
 - the charge that passes through the thermocouple.
27. The magnitude and direction of the magnetic Lorentz force is given by
- $\vec{F} = (\vec{v} \times \vec{B})$
 - $\vec{F} = q / (\vec{v} \times \vec{B})$
 - $\vec{F} = q (\vec{v} \times \vec{B})$
 - $\vec{F} = v (\vec{q} \times \vec{B})$.
28. Which of the following devices does not allow direct current (D.C.) to pass through ?
- Capacitor
 - Inductor
 - Resistor
 - All of these.
29. Electromagnetic induction is not used in
- transformer
 - room heater
 - choke coil
 - A.C. generator.
30. A coil of area of cross-section 0.5 m^2 with 10 turns is in a plane which is perpendicular to a uniform magnetic field of 0.2 Wb/m^2 . The magnetic flux through the coil is
- 100 Wb
 - 10 Wb
 - 1 Wb
 - zero.

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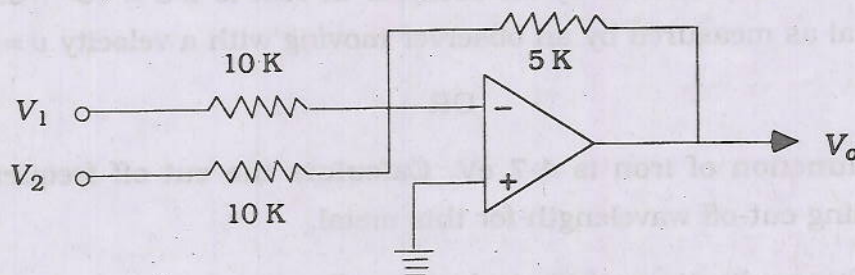
PART - II

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

31. Define electric potential at a point.
32. Why is it safer to be inside a car than standing under a tree during lightning ?
33. The resistance of a nichrome wire at 0°C is $10\ \Omega$. If its temperature coefficient of resistance is $0.004/^{\circ}\text{C}$, find its resistance at boiling point of water. Comment on the result.
34. Distinguish between electric power and electric energy.
35. Define drift velocity.
36. How is a galvanometer converted into
 - a) an ammeter
 - b) a voltmeter ?
37. Define coefficient of self induction.
38. Calculate the capacitive reactance of a capacitor of capacitance $2\ \mu\text{F}$ in an A.C. circuit of frequency $1000\ \text{Hz}$.
39. What is Tyndall scattering ?
40. A light of wavelength $6000\ \text{\AA}$ falls normally on a thin air film. 6 dark fringes are seen between two points. Calculate the thickness of the air film.
41. What are the characteristics of Laser ?
42. Define ionization potential energy.
43. State the postulates of special theory of relativity.
44. The radioactive isotope ${}_{84}\text{Po}^{214}$ undergoes a successive disintegration of two α -decays and two β -decays. Find the atomic number and mass number of the resulting isotope.
45. How do you classify the neutrons in terms of its kinetic energy ?

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46. Find the output of the given circuit :



47. What is an integrated circuit ?
48. Give the Barkhausen conditions for oscillator.
49. Mention any three uses of Cathode Ray Oscilloscope (CRO).
50. What is meant by skip distance ?

PART - III

N. B. : i) Answer Question No. 58 compulsorily.

ii) Answer any six of the remaining 11 questions,

iii) Draw diagrams wherever necessary.

$7 \times 5 = 35$

51. The plates of a parallel plate capacitor have an area of 90 cm^2 each and are separated by 2.5 mm. The capacitor is charged by connecting it to a 400 V supply. How much electrostatic energy is stored by the capacitor ?
52. Obtain the condition for bridge balance in Wheatstone's bridge.
53. Explain the working of a Daniel cell with a diagram.
54. State and explain Biot-Savart law.
55. An a.c. generator consists of a coil of 10,000 turns and of area 100 cm^2 . The coil rotates at an angular speed of 140 r.p.m. in a uniform magnetic field of $3.6 \times 10^{-2} \text{ T}$. Find the maximum value of the e.m.f. induced.
56. Write a note on pile of plates.
57. Write any five properties of cathode rays.

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58. The time interval measured by an observer at rest is 2.5×10^{-8} s. What is the time interval as measured by an observer moving with a velocity $v = 0.73 C$?

OR

The work function of iron is 4.7 eV. Calculate the cut-off frequency and the corresponding cut-off wavelength for this metal.

59. Write any five applications of Photoelectric cells.
60. Explain the latitude effect of cosmic rays.
61. Explain how transistor biasing is provided by voltage divider bias method.
62. Mention the merits and demerits of digital communication.

PART - IV

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

ii) Draw diagrams wherever necessary.

$4 \times 10 = 40$

63. Derive an expression for electric field due to an electric dipole at a point along the equatorial line.
64. Define Ampere's circuital law. Applying it find the magnetic induction due to a long solenoid carrying current.
65. A source of alternating e.m.f. is connected to a series combination of a resistor R , an inductor L and a capacitor C . Obtain with the help of a vector diagram and impedance diagram, an expression for (i) the effective voltage, (ii) the impedance, (iii) the phase relationship between the current and the voltage.
66. Explain emission and absorption spectra.
67. State the postulates of Bohr atom model. Obtain an expression for the radius of n^{th} orbit of an electron of hydrogen atom based on Bohr's theory.
68. Explain the principle, construction and working of a Geiger-Müller counter.
69. Sketch the circuit of Colpitts oscillator. Explain its working.
70. Explain the construction and working of a vidicon camera tube with neat diagram.