**J2022**

No. of Printed Pages : 4

Register Number

**A**

# PART – III

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(English Version)

Time Allowed : 3.00 Hours ]                     [ Maximum Marks : 70

**Instructions** : (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

## PART – I

**Note** : (i) Answer **all** the questions.                                          15x1=15

(ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1. The ratio between the radius of first three orbits of hydrogen atom is:
   (a) 1:2:3          (b) 1:2:2          (c) 1:4:9          (d) 1:3: 5

2. Two coherent monochromatic light beams of intensities I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are:
   (a) 5I and I       (b) 5I and 3I      (c) 9I and I       (d) 9I and 3I

3. A wire connected to a power supply of 230 V has power dissipation $P_1$. Suppose the wire is cut into two equal pieces and connected parallel to the same power supply.

   $P_2$ In this case power dissipation is $P_2$ The ratio $\frac{P_2}{P_1}$ is :

   (a) 1              (b) 2              (c) 3              (d) 4

4. Stars twinkle due to:
   (a) Reflection                       (b) Total internal reflection
   (c) Refraction                       (d) Polarisation

5. The instantaneous values of alternating current and voltage in a circuit are

   $i = \frac{1}{\sqrt{2}} \sin (100\pi t)$ A and $v = \frac{1}{\sqrt{2}} \sin \left(100\pi t + \frac{\pi}{3}\right)$V.

   The average power in watts consumed in the circuit is:

   (a) $\frac{1}{4}$     (b) $\frac{\sqrt{3}}{4}$     (c) $\frac{1}{2}$     (d) $\frac{1}{8}$

6. If the mean wavelength of light from Sun is taken as 550 nm and its mean power as 3.8x $10^{26}$ W then, the average number of photons received by the human eye per second from Sunlight is of the order of:
   (a) $10^{45}$         (b) $10^{42}$         (c) $10^{54}$         (d) $10^{51}$

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7. An electric dipole is placed at an alignment angle of 30° with an electric field of $2 \times 10^5$ NC$^{-1}$, It experiences a torque equal to 8 Nm. The charge on the dipole if the dipole length is 1 cm is

(a) 4 mC          (b) 8 mC          (c) 5 mC          (d) 7 mC

8. Fraunhofer lines are an example of spectrum.

(a) line emission                     (b) line absorption

(c) band emission                   (d) band absorption

9. The mass of a $^7_3Li$ nucleus is 0.042 u less than the sum of the masses of all its 3 nucleons. The average binding energy per nucleon $^7_3Li$ nucleus is nearly :

(a) 46 MeV        (b) 5.6 MeV        (c) 3.9 MeV        (d) 23 MeV

10. The temperature co-efficient of resistance of a wire is 0.00125 per °C. At 20°C, its resistance is 1 Ω. The resistance of the wire will be 2 Ω at

(a) 800°C         (b) 700°C         (c) 850°C         (d) 820°C

11. The particle size of ZnO material is 30 nm. Based on the dimension it is classified as :

(a) Bulk material     (b) Nanomaterial     (c) Soft material     (d) Magnetic material

12. The value of L, C and R of an AC circuit are 1 H, 9 F and 3 Ω respectively. The quality factor for this circuit is :

(a) 1             (b) 9            (c) $\frac{1}{9}$           (d) $\frac{1}{3}$

13. A circular coil of radius 5 cm and 50 turns carries a current of 3 ampere. The magnetic dipole moment of the coil is nearly

(a) 1.0 Am$^2$       (b) 1.2 Am$^2$       (c) 0.5 Am$^2$       (d) 0.8 Am$^2$

14. Two radiations with photon energies 0.9 eV and 3.3 eV respectively are falling on a metallic surface successively. If the work function of the metal is 0.6 eV, then the ratio of maximum speeds of emitted electrons in the two cases will be

(a) 1:4         (b) 1:3         (c) 1: 1         (d) 19

15. If a positive half-wave rectified voltage is fed to a load resistor, for which part of a cycle of the input signal there will be current flow through the load?

(a) 0° 90°         (b) 90° - 180°       (c) 0 – 180°       (d) 0° 360°

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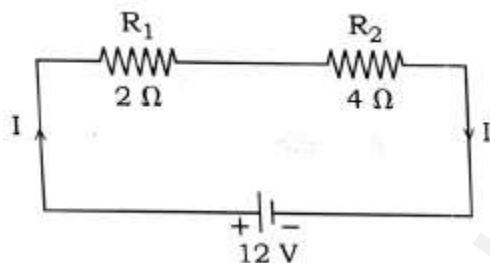**PART – II**                                                              **J2022**

**Note** : Answer **any six** questions. Question No. **24** is **compulsory.**          6x2=12

16. Mention the ways of producing induced emf.

17. Define stopping potential.

18. Give two uses of UV radiation.

19. Pure water has refractive index 1.33. What is the speed of light through it ?

20. Define ampere in terms of force.

21. What is rectification?

22. State Gauss law.

23. Define atomic mass unit.

24. Calculate the equivalent resistance for the circuit which is connected to 12 V battery and also find the potential difference across 2 Ω and 4 Ω resistors in the circuit.



**PART – III**

**Note** : Answer **any six** questions. Question No. **33** is **compulsory.**          6x3=18

25. Obtain an expression for energy stored in the parallel plate capacitor.

26. An electron moving perpendicular to a uniform magnetic field 0.500 T undergoes circular motion of radius 2.50 mm. What is the speed of electron?

27. Give the construction and working of a photo emissive cell.

28. Mention the differences between interference and diffraction.

29. What is Zener diode? Mention any two uses of Zener diode.

30. What is Seebeck effect? State the applications of Seebeck effect.

31. What are the properties of Cathode rays?

32. AC is advantageous than DC. Explain.

33. Light travels from air into a glass slab of thickness 50 cm and refractive index 1.5 What is the speed of light in the glass slab and what is the time taken by the light to travel through the glass slab.

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## PART – IV

**Note :** Answer **all** the questions.                                         5x5=25

34.  (a)  Obtain the condition for bridge balance in Wheatstone's bridge.

**(OR)**

(b)  (i)  What is half-life and mean life of a radioactive nucleus?

(ii)  Calculate the number of nuclei of carbon-14 un-decayed after 22,920 years if the initial number of carbon-14 atoms is 10,000. The half –life of carbon-14 is 5730 years.

35.  (a)  Describe the Fizeau's method to determine the speed of light.

**(OR)**

(b)  (i)  Write down the properties of electromagnetic waves.

(ii)  The relative magnetic permeability of the medium is 2.5 and the relative electrical permittivity of the medium is 2.25. Compute the refractive index of the medium.

36.  (a)  Explain in detail the construction and working of a Van de Graaff generator.

**(OR)**

(b)  Explain about Compound Microscope and obtain the equation for the Magnification.

37.  (a)  Show that the mutual inductance between a pair of coils is same ($M_{12}$= $M_{21}$).

**(OR)**

(b)  State and prove De Morgan's first and second theorem.

38.  (a)  (i)  Obtain Einstein's photoelectric equation with necessary explanation.

(ii)  List out the characteristics of photons.

**(OR)**

(b)  Derive the expression for the force on a current carrying conductor in a magnetic field.

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