

TIME: 3.00 hours

- Instructions: i) Check the question paper for fairness of printing. If there is lack of fairness, inform the Hall Supervisor immediately.  
 ii) Use blue or black ink to write and underline and pencil to draw diagram.

## PART - I

Note:

i) Answer all questions.

15 x 1 = 15

ii) Choose the Correct answer from the four alternatives and write the option code and the corresponding answer.

- An electric field  $\vec{E} = 10x \hat{i}$  exists in a certain region of space. Then the potential difference  $V = V_0 - V_A$  where  $V_0$  is the potential at the origin and  $V_A$  is the potential at  $x = 2\text{m}$  is:
  - 10V
  - 20V
  - +20V
  - 10V
- Three capacitors each of the capacitance "C" are given, the resultant capacitance  $\frac{2}{3} C$  can be obtained by using them.
  - All in series
  - all in parallel
  - two in parallel and third in series with this combination
  - two in series and third in parallel across the combination.
- The internal resistance of a cell 2.1 V which gives a current of 0.2 A through resistance of  $10\Omega$  is
  - 0.2  $\Omega$
  - 0.5  $\Omega$
  - 0.8  $\Omega$
  - 1.0  $\Omega$
- Magnetic field has the unit of
  - $\text{NA}^2 \text{m}^{-1}$
  - $\text{NA}^{-2} \text{m}^{-1}$
  - $\text{NA}^{-1} \text{m}^{-1}$
  - $\text{NA} \text{m}^{-1}$
- A circular current carrying coil of Radius 'R'. At what point from the centre of the coil along its axis the magnetic induction will be  $\left(\frac{1}{8}\right)$  times the field at the centre of the coil.
  - $\sqrt{3} R$
  - $2R\sqrt{3}$
  - $\frac{R}{\sqrt{3}}$
  - $\frac{2R}{\sqrt{3}}$
- The instantaneous values of a lternating current and voltage in a circuit are  $i = \frac{1}{\sqrt{2}} \sin(100\pi t)$  A and  $v = \frac{1}{\sqrt{2}} \sin(100\pi t)$  V. The average power in watts consumed in the circuit is
  - $\frac{1}{4}$
  - $\frac{\sqrt{3}}{4}$
  - $\frac{1}{2}$
  - $\frac{1}{8}$

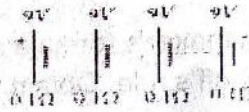
7. Which of the following is NOT true for electromagnetic waves?
- it transport energy
  - it transport momentum
  - it transport angular momentum
  - in vacuum, it travels with different speeds which depend on their frequency
8. A plane glass is placed over a various coloured letters (violet, green, yellow, red) The letter which appears to be raised more is,
- red
  - yellow
  - green
  - violet
9. Two light sources have intensity of light as  $I_0$ . The resultant intensity ( $I$ ) at a point Where the two light waves have a phase difference of  $\frac{\pi}{3}$  is
- $\frac{I_0}{2}$
  - $3 I_0$
  - $\frac{I_0}{3}$
  - $2 I_0$
10. The work functions for metals A, B and C are 1.92 eV, 2.0 eV and 5.0 eV respectively. The metals which will emit photoelectrons for a radiation of wavelength  $4100 \text{ \AA}$  is / are
- A only
  - both A and B
  - all these metals
  - none
11. The spectral series of hydrogen atom which fall in visible light region is
- Balmer series
  - Paschen series
  - Lyman series
  - Brackett series
12. A system consists of  $N_0$  nucleus at  $t=0$ . The number of nuclei remaining after half of a half - life (that is, at time  $(t = \frac{1}{2} T_{1/2})$ )
- $\frac{N_0}{2}$
  - $\frac{N_0}{4}$
  - $\frac{N_0}{8}$
  - $\frac{N_0}{\sqrt{2}}$
13. Let  $(\alpha)$  and  $(\beta)$  are the current gain of a transistor in CB & CE configuration respectively of. Then  $\frac{1}{\alpha} - \frac{1}{\beta} = \dots\dots\dots$
- 0
  - 1
  - 1000
  - $\infty$
14. The internationally accepted frequency deviation for the purpose of FM broadcasts
- 75 kHz
  - 68 kHz
  - 80 kHz
  - 70 kHz
15. Which one of the following is the natural nanomaterial.
- Peacock feather
  - Peacock beak
  - Grain of sand
  - Skin of the Whale

## PART - II

Answer any 6 Questions:

(Question no 23 is Compulsory)

16. What is the general definition of electric dipole moment?
17. From the given circuit, Find i) Equivalent emf of the combination  
ii) Equivalent internal resistance



$$R = 10\Omega$$

18. State Ampere's circuital law.
19. A straight metal wire crosses a magnetic field of flux 4 mWb in a time 0.4 s. Find the magnitude of the emf induced in the wire.
20. What is shortsightedness? What is its remedy?
21. Define the term "Threshold frequency"
22. Write any four properties of cathode ray.
23. In a transistor connected in the common base configuration, the values of  $I_E = 1 \text{ mA}$ ,  $I_C = 0.95 \text{ mA}$ . Calculate the value current gain in CB mode.
24. Give any two uses of RADAR.

## PART - III

Answer any 6 Questions:

(Question no: 33 Compulsory)

25. Consider a point charge +q placed at the origin and another point charge -2q, placed at a distance of 9m from the charge +q. Determine the distance of the point from the -2q at which electric potential is zero.
26. Explain the determination of the internal resistance of a cell using voltmeter.
27. Compare dia, para and ferro - magnetism.
28. Explain the phase relationship between voltage and current in a pure resistive circuit with phasor and wave diagrams.
29. Explain the principle construction and working of Thermopile.
30. Derive the expression for de - Broglie wavelength of matter waves.
31. Give the symbolic representation of alpha decay, beta decay and gamma decay.
32. State and prove De Morgan's First and Second theorems.
33. A compound microscope has a magnification of 30. The focal length of eye piece is 5 cm. Assuming the final image to be at least distance of distinct vision, find the magnification produced by the objective.

## PART - IV

5 x 5 = 25

## Answer all Questions:

34. a) Derive the expression for resultant capacitance, when capacitors are connected in series and in parallel.

(Or)

- b) Obtain lens maker's formula and lens formula.

35. a) State Kirchhoff's rule. Obtain the condition for bridge balance in Wheatstone's bridge.

(Or)

- b) Give the construction and working of photo emissive cell. Explain its applications

36. a) Derive the expression for force on a current carrying conductor placed in a magnetic field. Discuss the special cases also define Fleming's left hand rule.

(Or)

- b) Using Bohr's atom model derive an expression for radius and velocity of electron in an orbit.

37. a) Derive the expression for self inductance of a long solenoid, and also prove energy stored in an inductor is  $U_L = \frac{1}{2} Li^2$

(Or)

- b) What are rectifiers? Explain in detail the construction and working of Full wave rectifier with its circuit diagram and necessary wave forms.

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

(Or)

- b) Derive the equation for angle of deviation produced by a prism and thus obtain

the Equation for refractive index of material of the prism,  $n = \frac{\sin \frac{A + D}{2}}{\sin \frac{A}{2}}$  by explaining angle of minimum deviation using graph.

Sivakumar. M, Sri Ram Matric HSS,  
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 Vallam-627809.