

~~12021~~OBJECTIVE

NOTE: You have four choices for each objective type question as A , B , C and D . The choice which you think is correct , fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question

## QUESTION NO. 1

|    |   |
|----|---|
| 1  | A particle of charge $2e$ falls through potential difference of 3.0 V will have energy<br>(A) 1.5 eV (B) 0.66 eV (C) 6 eV (D) 12 eV   |
| 2  | The minimum value of charge on free particle is<br>(A) $\frac{2}{3}e$ (B) $\frac{1}{3}e$ (C) $\frac{-2}{3}e$ (D) $e$  |
| 3  | The SI unit of conductance is<br>(A) Siemen (B) Ohm (C) Henry (D) Weber   |
| 4  | In the expression $\frac{e}{m} = \frac{V}{Br}$ , the radius is measured by making electronic trajectory<br>(A) Hyperbolic (B) Ellipse (C) Dark (D) Visible                                |
| 5  | Output waveform of built-in voltage of the CRO is<br>(A) Sinusoidal (B) Square (C) Rectangular (D) Saw tooth  |
| 6  | The Lenz's law is also a statement of law of conservation of<br>(A) Charge (B) Parity (C) Mass (D) Energy   |
| 7  | The principle of A.C generator is<br>(A) Lenz's law (B) Faraday's law (C) Mutual induction (D) Coulomb's law  |
| 8  | In A.C through resistance, current and voltage are<br>(A) in phase (B) out of phase (C) current leads (D) 90° phase difference  |
| 9  | The unit of $\frac{WL}{R}$ in R - L series circuit is<br>(A) Ohm (B) Volt (C) Henry (D) Unitless  |
| 10 | The most suitable metal for making permanent magnet is<br>(A) Iron (B) Steel (C) Silver (D) Copper  |
| 11 | Base of the transistor is very thin of the order of the<br>(A) $10^{-6}$ m (B) $10^{-2}$ m (C) $10^{-1}$ m (D) $10^{-3}$ m  |
| 12 | The operational amplifier, when works as inverting amplifier. The phase change between its input and output is<br>(A) 90° (B) 120° (C) 150° (D) 180°                                      |
| 13 | The factor $\frac{h}{m_0c}$ has the unit of<br>(A) Kilogram (B) Second (C) Meter (D) Joule  |
| 14 | Which properties of radio waves are predominate ?<br>(A) Wave (B) Particle (C) Partial wave (D) Partial particle  |
| 15 | Finely focused beam of laser has been used to destroy<br>(A) Crystal structure (B) Cancerous cells (C) Weapons (D) Germs  |
| 16 | Baryon with combination of up , up and up quark has charge<br>(A) $1e$ (B) $2e$ (C) $-1e$ (D) $-2e$   |
| 17 | ${}^2_1\text{H} + {}^2_1\text{H} \longrightarrow {}^3_1\text{H} + X + 4.0 \text{ Mev}$ . The particle X is<br>(A) ${}^1_0\text{n}$ (B) ${}^1_1\text{H}$ (C) ${}^2_1\text{H}$ (D) electron |

QUESTION NO. 2 Write short answers any Eight (8) of the following

16

- 1 Show that :  $1 \frac{\text{volt}}{\text{meter}} = 1 \frac{\text{newton}}{\text{coulomb}}$
- 2 Two opposite point charges, each of magnitude  $q$  are separated by a distance  $2d$ . What is the electric potential at a point  $P$  mid-way between them?
- 3 Is  $E$  necessarily zero inside a charged rubber balloon if balloon is spherical? Assume that charge is distributed uniformly over the surface.
- 4 Is it true that Gauss's law states that the total number of lines of forces crossing any closed surface in the outward direction is proportional to the net positive charge enclosed within surface?
- 5 The magnetic field in a certain region is given by  $\vec{B} = (40 \hat{i} - 18 \hat{k}) \text{ wbm}^{-2}$ . How much flux passes through a  $5.0 \text{ cm}^2$  area loop in this region if the loop lies flat in the  $XY$ -plane?
- 6 Prove that  $\vec{F} = q\vec{E} + q(\vec{V} \times \vec{B})$
- 7 Why does the picture on a TV screen become distorted when a magnet is brought near the screen?
- 8 How can a current loop be used to determine the presence of a magnetic field in a given region of space?
- 9 How can an induced current be increased?
- 10 Define mutual inductance and write its unit
- 11 Does the induced *emf* in a circuit depend on the resistance of the circuit? Does the induced current depend on the resistance of the circuit?
- 12 In a certain region, the earth's magnetic field point vertically down. When a plane flies due north, which wingtip is positively charged?

QUESTION NO. 3 Write short answers any Eight (8) of the following

16

- 1 What are thermistors? For what they are used for?
- 2 Do bends in a wire affect its electrical resistance? Explain
- 3 Describe a circuit which will give a continuously varying potential
- 4 What are the average values of current ' $I$ ' and voltage ' $V$ ' over a cycle of alternating current? What are the average values of  $I^2$  and  $V^2$  over a cycle?
- 5 What is impedance? Give its unit
- 6 How does doubling the frequency affect the reactance of (a) an inductor (b) a capacitor?
- 7 What is difference between ductile and brittle substances? Give example of each
- 8 Define modulus of elasticity. Also discuss its three kinds
- 9 What is meant by para, dia and ferromagnetic substances? Give examples for each
- 10 What is a light emitting diode? Give its applications
- 11 Describe the variation of size and the difference in concentration of impurity in different parts of a transistor
- 12 What is the principle of virtual ground?

QUESTION NO. 4 Write short answers any Six (6) of the following

12

- 1 As a solid is heated and begins to glow, why does it first appear red?
- 2 Which has the lower energy quanta? Radio waves or X-rays
- 3 A particle of mass  $5.0 \text{ mg}$  moves with speed of  $8.0 \text{ m/s}$ . Calculate its de-Broglie wavelength
- 4 Can X-rays be reflected, refracted, diffracted and polarized just like any other waves? Explain
- 5 What is difference between spontaneous and stimulated emission?
- 6 If a nucleus has a half life of 1 year, does this mean that it will be completely decayed after 2-years. Explain
- 7 What information is revealed by the length and shape of the tracks of an incident particle in Wilson Cloud Chamber?
- 8 Define hadrons. Also differentiate between baryons and mesons
- 9 Define Half life and write its mathematical formula

**SECTION-II**

Note: Attempt any Three questions from this section

8 x 3 = 24

- |         |   |   |
|---------|---|---|
| Q.5.(A) | By using Millikan oil drop experiment, How can the charge on electron be measured   | 5 |
| (B)     | The resistance of an iron wire at $0^\circ\text{C}$ is $1.0 \times 10^4 \Omega$ . What is the resistance at $500^\circ\text{C}$ if the temperature coefficient of resistance of iron is $5.2 \times 10^{-3} \text{ K}^{-1}$ ? | 3 |
| Q.6.(A) | What is cathode Ray Oscilloscope? Explain the functions of (i) Cathode (ii) Grid (iii) Anodes (iv) Deflecting plates and (v) Sweep generator  | 5 |
| (B)     | A solenoid has 250 turns and its self inductance is 2.4 mH. What is the flux through each turn when the current is 2A? What is the induced <i>emf</i> when the current changes at $20 \text{ AS}^{-1}$ ?                      | 3 |
| Q.7.(A) | What is p-n junction? Describe forward and reverse biased p-n junction. Discuss the characteristics curves in short   | 5 |
| (B)     | Find the value of the current flowing through a capacitance $0.5 \mu\text{F}$ when connected to a source of 150 V at 50 Hz  | 3 |
| Q.8.(A) | Write a brief note on nuclear fission   | 5 |
| (B)     | A 1.25 cm diameter is subjected to a load of 2500 kg. Calculate the stress on the bar in mega-Pascals   | 3 |
| Q.9.(A) | Explain photoelectric effect on the basis of classical and quantum theory   | 5 |
| (B)     | The wave length of K X-ray from copper is $1.377 \times 10^{-10} \text{ m}$ . What is the energy difference between two levels from which this transition results?  | 3 |

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## QUESTION NO. 1

- |    |   |
|----|---|
| 1  | The core of the transformer is laminated to reduce<br>(A) Magnetic loss (B) Electric loss (C) Eddy current loss (D) Hysteresis loss   |
| 2  | The capacitive reactance to a pure D.C is<br>(A) Zero (B) Infinite (C) 2 Ohm (D) 3 Ohm  |
| 3  | At resonance, the impedance of RLC series circuit is<br>(A) Zero (B) Minimum (C) Maximum (D) Variable   |
| 4  | Glass and high carbon steel are the example of<br>(A) Ductile substance (B) Brittle substance (C) Soft substance (D) Magnetic substance   |
| 5  | The colour of light emitting diode (LED) depends upon<br>(A) The type of semiconductor material (B) The amount of forward current (C) Its forward Biasing<br>(D) Its reverse Biasing                        |
| 6  | The voltage gain of an inverting operational amplifier is given by input and output is<br>(A) $G = 1 - \frac{R_2}{R_1}$ (B) $G = 1 - \frac{R_1}{R_2}$ (C) $G = \frac{R_1}{R_2}$ (D) $G = - \frac{R_2}{R_1}$ |
| 7  | In order to increase the K.E of ejected photo-electron , there should be an increase in<br>(A) Intensity of light (B) Wavelength of radiation (C) Frequency of radiation (D) Power of radiation             |
| 8  | Which of the following phenomena proves the particle nature of light<br>(A) Diffraction (B) Interference (C) Polarization (D) Photoelectric effect  |
| 9  | X-rays has charge<br>(A) Positive (B) Negative (C) Zero (D) As that of $\alpha$ -particle   |
| 10 | The building block of protons and neutrons are called<br>(A) Electron (B) Ions (C) Quarks (D) Positron  |
| 11 | In nuclear fission reaction , when the products are $^{140}\text{Xe}$ and $^{94}\text{Sr}$ , the number of neutrons emitted are<br>(A) 1 (B) 2 (C) 3 (D) 4  |
| 12 | The charge on the oil droplet in Millikan's oil drop experiment calculated by using formula<br>(A) $q = \frac{mg}{d}$ (B) $q = \frac{v}{mgd}$ (C) $q = \frac{mgd}{v}$ (D) $q = \frac{d}{mgv}$               |
| 13 | One electron volt is equal to<br>(A) $6.25 \times 10^{18}\text{J}$ (B) $6.25 \times 10^{-18}\text{J}$ (C) $1.6 \times 10^{-19}\text{J}$ (D) $1.6 \times 10^{19}\text{J}$                                    |
| 14 | The substance having negative temperature co-efficient is<br>(A) Carbon (B) Iron (C) Tungsten (D) Gold  |
| 15 | The SI unit of magnetic flux is given by<br>(A) $\text{NmA}^{-1}$ (B) $\text{NA}^{-1}\text{m}^{-1}$ (C) $\text{Nm}^2\text{A}^{-1}$ (D) $\text{Nm}^{-1}\text{A}$   |
| 16 | When a charge is projected perpendicular to a uniform magnetic field, then its path followed will be<br>(A) Straight line (B) Circle (C) Ellipse (D) Helix  |
| 17 | If 10A current passes through 100 mH inductor, then energy stored is<br>(A) 100 J (B) 5 J (C) 20 J (D) Zero   |

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QUESTION NO. 2 Write short answers any Eight (8) of the following

16

- 1 Is  $\vec{E}$  necessarily zero inside a charged rubber balloon, if balloon is spherical ?
- 2 Do electron tend to go to region of high potential or of low potential ?
- 3 Prove that the unit of time and unit of product of resistance and capacitance of capacitor (RC) are same ?
- 4 Define electron volt and show that  $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$
- 5 Why does the picture on a TV screen becomes distorted when a magnet is brought near the screen ?
- 6 How can you use a magnetic field to separate isotopes of chemical element ?
- 7 What is meant by Lorentz force ? Write down its formula
- 8 Write two uses of cathode ray Oscilloscope
- 9 Does the induced *emf* always act to decrease the magnetic flux through a circuit ? Explain
- 10 Show that  $\mathcal{E}$  and  $\frac{\Delta\phi}{\Delta t}$  have the same units ?
- 11 Define Faraday's law
- 12 Name the factors upon which the self inductance depends

QUESTION NO. 3 Write short answers any Eight (8) of the following

16

- 1 A potential difference is applied across the ends of a copper wire. What is the effect on the drift velocity of free electrons by (a) Increasing potential difference (b) Decreasing the length and the temperature of the wire
- 2 What are the difficulties in testing whether the filament of light bulb obeys Ohm's law ?
- 3 A carbon resistance has red , violet, orange and silver colour. What will be its resistance and tolerance ?
- 4 How many times per second will an incandescent lamp reach maximum brilliance when connected to 50 Hz source ?
- 5 At frequency of 80 Hz , the reactance of inductor is  $500 \Omega$  . What will be the inductance ?
- 6 In a R-L series circuit, will the current lag or lead the voltage ? Illustrate your answer by making vector diagram.
- 7 Differentiate between tensile and compressive mode of stress and strain
- 8 Define Curie temperature. What is Curie temperature for iron ?
- 9 What is meant by hysteresis loss ?
- 10 Why charge carriers are not present in the depletion region ?
- 11 The anode of a diode is 0.2 V positive with respect to its cathode. Is it forward biased ?
- 12 Why the base of transistor is kept small ?

QUESTION NO. 4 Write short answers any Six (6) of the following

12

- 1 State Compton effect and write an expression for Compton shift
- 2 Why do not we observe a Compton effect with visible light ?
- 3 Can pair production take place in vacuum ? Explain
- 4 Write postulates of Bohr's model of the hydrogen atom
- 5 Explain why laser action cannot occur without population inversion between atomic levels
- 6 Write name of two main types of nuclear reactors
- 7 What do you understand by back ground radiation ? State two sources of this radiation
- 8 What fraction of a radioactive sample decays after two half lives have elapsed ?
- 9 Discuss the advantages and disadvantages of fission power from the point of safety, pollution and resources

**SECTION-II**

Note: Attempt any Three questions from this section

8 x 3 = 24

- |         |   |   |
|---------|---|---|
| Q.5.(A) | Derive and expression for stored energy density in the electric field of capacitor  | 5 |
| (B)     | A rectangular bar of iron is 2.0 cm by 2.0 cm in cross-section and 40 cm long. Calculate its resistance if the resistivity of iron is $11 \times 10^{-8} \Omega \text{ m}$ .  | 3 |
| Q.6.(A) | Prove that magnetic energy stored in an inductor is $U_m = \frac{1}{2} \frac{B^2}{\mu_0} (Al)$  | 5 |
| (B)     | How fast must a proton move in a magnetic field of $2.50 \times 10^{-3} \text{ T}$ such that the magnetic force is equal to its weight  | 3 |
| Q.7.(A) | Describe series resonance circuit. Find formula for resonance frequency and write its properties  | 5 |
| (B)     | In a certain circuit, the transistor has a collector current of 10 mA and a base current of $40 \mu\text{A}$<br>What is the current gain of the transistor ?  | 3 |
| Q.8.(A) | What is energy band theory ? How it can be used to explain different features of electrical conductors, insulators and semiconductors ?   | 5 |
| (B)     | Find the mass defect and binding energy of the deuteron nucleus. The experimental mass of deuteron is $3.3435 \times 10^{-27} \text{ kg}$   | 3 |
| Q.9.(A) | What is de-Broglie Hypothesis ? Describe Davison and Germer experiment to prove the hypothesis  | 5 |
| (B)     | The orbital electron of a hydrogen atom moves with a speed of $5.456 \times 10^5 \text{ ms}^{-1}$ . Find the value of the quantum number 'n' associated with this electron and the energy of the electron in this orbit | 3 |