

SAMPLE QUESTION PAPER
(AS PER NEW PATTERN-MARCH 2015)

MAX.MARKS- 70

TIME- 3 HOURS

General Instructions :

- (i) All questions are compulsory.
- (ii) Question numbers 1 to 5 are very short answer type questions, carrying **one** mark each.
- (iii) Question numbers 6 to 10 are short answer type questions, carrying **two** marks each.
- (iv) Question numbers 11 to 22 are also short answer type questions, carrying **three** marks each.
- (v) Question number 23 is value based question, carrying 4 marks.
- (vi) Question numbers 24 to 26 are long answer type questions, carrying **five** marks each.
- (vii) Use of calculators is not permitted. However, you may use log tables, if necessary.
- (viii) You may use the following values of physical constants wherever necessary

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

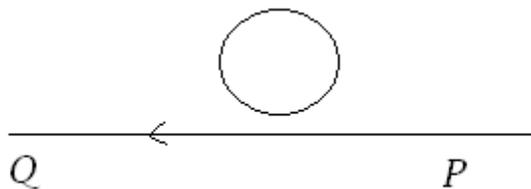
$$\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$$

$$\text{Mass of neutron } m_n = 1.6 \times 10^{-27} \text{ kg}$$

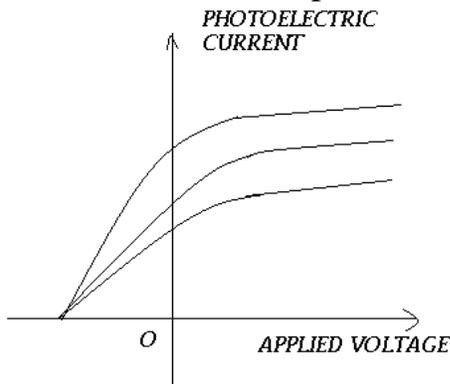
$$\text{Boltzmann, s constant } k = 1.38 \times 10^{-23} \text{ J/K}$$

$$\text{Avagadro's number } N_A = 6.023 \times 10^{23} \text{ /mole}$$

- 1) Draw the graph between electric field strength and distance from the centre of the hollow conducting charged sphere.
- 2) The electric current passing through a wire in the direction from P to Q is decreasing. What is the direction of induced current in the metallic loop kept above the wire as shown in the figure?



- 3) Which among X-rays, sound waves and radio waves can be polarized?
- 4) What is photodiode? Draw its symbol.
- 5) In a photoelectric effect experiment, the following graphs were obtained between the photoelectric current and the applied voltage. Name the characteristic of the incident radiation that was kept constant in this experiment.



- 6) Two capacitors of capacitances $3\mu\text{F}$ and $6\mu\text{F}$ are charged to potentials of 2V and 5V respectively. These two charged capacitors are connected in series. Find the potential across each of the two capacitors now?
- 7) Length of a given conductor is increased to 3 times by stretching it. What is its effect on drift velocity and resistivity?
(Assume potential difference across the conductor is kept constant).
- 8) What is potential gradient? Write its unit . Write its expression in terms of specific resistance of the wire.

(OR)

Draw the graphs showing variation of resistivity with temperature for metals and silicon.

9) State Biot –Savart’s law. Using it, write the expression for the magnetic field at the centre of the circular current carrying coil of radius ‘a’.

10) A circular copper disc, 10cm in radius rotates at 20π rad/s about an axis through its centre and perpendicular to the disc. A uniform magnetic field of 0.2 T acts perpendicular to the plane of the disc.

(i) Calculate the potential difference developed between the axis of the disc and the rim.

(ii) What is the induced current if the resistance of the disc is 2 ohm.

11) The threshold frequency for a certain metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on the surface of the metal. Find (i) work function (ii) maximum K.E of photoelectron ejected,(iii) threshold frequency.

12) (i) If the base region of a transistor is made large as compared to the usual transistor, how does it affect (a) collector current (b) current gain?(ii)Write the biasing conditions for a transistor.

13) A set of 4 cells each of emf 2V and internal resistance 1 ohm are connected across an external load of 10 ohms with 2 rows, 2 cells in each branch. Calculate the current in each branch and the potential difference across 10 ohms.

14) What is the force on a wire of length 2 cm placed inside a solenoid near its centre (a) making an angle of 60° with the axis (b) parallel to the axis (c) perpendicular to the axis? The wire carries a current of 1A and the magnetic field inside the solenoid is 0.4T.

15) Compare the any three properties of ferro, para and dia magnetic substances.

16) A 100V,50Hz source is connected to a series combination of an inductance of 100mH and resistance 20 ohms. Calculate the magnitude and phase of current. (Or)

A $25\mu\text{F}$ capacitor,0.1H inductor and 25 ohms resistor are connected in series with an ac source whose emf is given by $E = 310 \sin (314t)$

Calculate (a) frequency of the ac power supply?

(b) Impedance.

(c)Peak current in the circuit.

17) Explain various series of spectral lines of Hydrogen atom and draw energy level diagram.

18) Using the data given below, state which of the two given lenses will you prefer to construct the best possible

(i) Telescope (ii) Microscope. Also indicate which of the selected lenses is to be used as objective and as eyepiece in each case.

Lens	Power(P)	Aperture(A)
L ₁	6D	1 cm
L ₂	3 D	8 cm
L ₃	10 D	1 cm

19) A star converts all its hydrogen to helium achieving 100% helium composition. It then converts helium to carbon via the reaction



The mass of the star is 5×10^{30} kg and it generates energy at the rate of 5×10^{30} W.

Calculate (i) Total number of nuclear reactions, (ii) Total energy released

And (iii) How long will it take to convert all the helium to carbon at this rate.

20) Explain the following (a) ground wave communication (b) Sky wave communication and (c) space wave communication.

21) Define polarization of light. State and prove Brewster's law.

22) What is the power dissipated in the pure inductor circuit & derive the equation for energy stored in an inductor?

23) In the famous conversation, Rakesh Sharma, the first Indian Astronaut in space, was asked by the then Prime Minister Indira Gandhi as to how India looked from space. To which he replied '*Sare Jahan Se Achcha*' (better than the whole world). Answer the following questions based on above passage:

a. Which scientific mode of communication enabled The Prime Minister to speak to the Astronaut?

b. Name the scientific values displayed in this anecdote.

c. Which values are being reflected in the reply given by the astronaut?

24) Write the principle of a capacitor? Deduce the expression for the capacitance of a PPC and hence derive the expression for the energy stored in a capacitor.

(Or)

a) State Gauss's theorem in electrostatics.

b) Obtain expression for electric field at a point which is at a perpendicular distance 'r' from a plane infinite sheet of charge with uniform charge density.

25) a) State Huygen's principle.

b) Describe the single slit diffraction experiment and obtain the expression for fringe width.

(Or)

a) Derive the relation between the focal length of a convex lens in terms of the radii of curvature of the two surfaces and refractive index of its material. Write the sign conventions and two assumptions used in the derivation of the relation.

b) A convex lens of focal length 40 cm and a concave lens of focal length -25 cm are kept in contact with each other. What is the value of power of this combination?

26) a) With the help of a labeled diagram, explain how n-p-n transistor is used as an amplifier in CE configuration. Explain how the input and output in this case are out of phase.

b) A transistor operated in CE configuration at $V_c = 2V$ such that change in base current from $100\mu A$ to $200\mu A$ produces change in the collector current from $9mA$ to $16.5mA$. Calculate the current gain. OR

a) Explain the working of n-p-n transistor as an oscillator with the help of a labeled diagram.

b) Sketch the output waveform for the following inputs A and B obtained from NAND gate.

