

**ATUL VIDYALAYA**  
**SECOND PRELIMINARY EXAMINATION-2012-13**  
**PHYSICS**  
**PAPER - 1 (THEORY)**

**STD- XII**  
**DATE-23-11-12**  
**SESSION:I**

**MM-70**  
**TIME – 3 HRS**

*(Candidates are allowed additional 15 minutes for only reading the paper. They must NOT start writing during this time) Answer all questions in Part I and six questions from Part II, choosing two questions from each of the Sections A, B and C).*

**Part I (Compulsory)**

**Question 1**

**[20]**

**Answer all questions briefly and to the point**

- (i) Two equal & similar charges 0.03 m apart in air, repel each other with a force of 4.5 kgf. Find the charge in coulomb.
- (ii) Write down the dimensional formula of permittivity.
- (iii) Vehicles carrying highly inflammable material have chains hanging to the ground. Explain why.
- (iv) Calculate the capacity of earth in S.I. units. Radius of earth = 6400 km.
- (v) What is electrostatic shielding?
- (vi) What is the wavelength of light of frequency 100 Hz?
- (vii) Two straight conductors carrying currents  $i_1$  &  $i_2$  are oriented at right angles to each other. What will be the force between them if they are in the same plane?
- (viii) What is the power factor of the a.c. circuit while at resonance?
- (ix) Can electrolysis proceed using an ac source?
- (x) Radio telescopes are built on ground but X - ray astronomy is possible only from satellites orbiting the earth. Why?
- (xi) Radio waves diffract around buildings while light waves donot. Why?
- (xii) What type of wave front is obtained by a refracted wave when a plane wave suffers refraction through a double convex lens.
- (xiii) On moving the screen away from the source in Young's double slit experiment, does the fringe width increase or decrease?
- (xiv) Light from a narrow slit passes through two parallel slits 0.4 mm apart & the fringes when measured at a distance of 40 cm from the slit are 0.5 mm apart. Find the wave length of light.
- (xv) Is there any place on the surface of the earth, where the horizontal component of earth's magnetic field is zero?
- (xvi) Draw the symbol of the logic gate whose truth table is given below:

A	B	Y
0	0	1
1	0	0
0	1	0
1	1	0

- (xvii) Show graphically the continuous spectrum of X - rays, labeling the axis & marking  $\lambda_m$ .
- (xviii) What is meant by half life of radioactive substance?
- (xix) Draw the symbol for n-p-n transistor.
- (xx) What happens to the wavelength of a photon after it collides with an electron?

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Part-I

Answer six questions from this part, choosing two questions from each of the sections A, B and C.

Section A

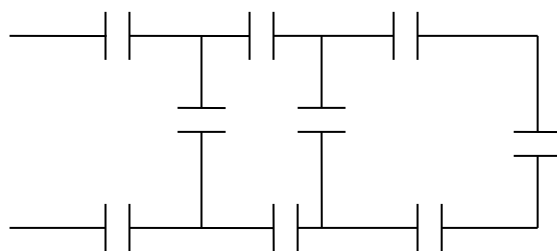
(Answer any two questions)

Question 2

- (a) Two spheres of charges +10 & +40 coulomb are placed 0.12 m apart. Find the position of the point between them where the intensity is zero. [3]
- (b) Derive the expression for the electric intensity due to a charged infinitely long straight cylindrical rod. [3]
- (c) An electric dipole consisting of charges  $2 \mu\text{C}$  each separated by  $10^{-2}$  m apart is placed in a uniform electric field of intensity  $3 \times 10^3$  N/C. Calculate the torque acting upon it when it is inclined to the lines of force field at an angle of  $45^\circ$ . [3]

Question 3

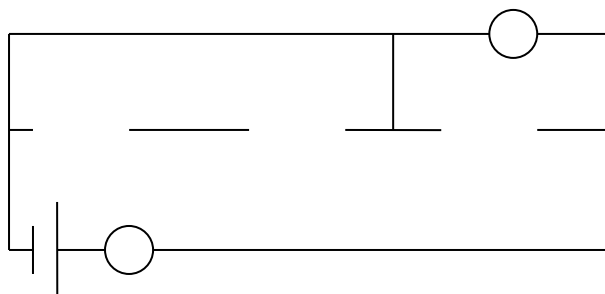
- (a) A number of capacitors are connected as shown in the figure. Calculate the equivalent capacity of the network between the points A & B when  $C_8$  &  $C_9$  have the capacity of  $2 \mu\text{F}$  whereas the rest have the capacity of  $3 \mu\text{F}$ . [4]



- (b) Show that when two equal capacitors are connected in parallel, the system has four times the capacity as obtained when they are in series. [2]
- (c) Obtain a relation connecting di-electric constant of the medium with its electric susceptibility. [3]

Question 4

- (a) Find the ammeter & voltmeter readings in the circuit shown below: [3]



- (b) Obtain the expression for the magnetic field due to the circular coil carrying current at the centre of the coil. [3]
- (c) The emf of a Cu-Fe thermocouple varies with the temperature of hot junction, cold junction at  $0^\circ\text{C}$  as  $E(\mu\text{V}) = 14\theta - 0.02\theta^2$ . Determine neutral temperature. [3]

Section B

(Answer any two questions)

Question 5

- (a) Two waves having intensities in the ratio of 9:1 produce interference. What will be the ratio of the intensity of maxima to that of minima? [3]
- (b) How will you prove that when light gets reflected from a denser medium there is a phase difference of  $\pi$  using Lloyd's mirror experiment. [3]
- (c) A better diffraction pattern is obtained if the size of the slit is small. Why? [2]

**Question 6**

- (a) An object is placed at a distance of 1.50 m from a screen & a convex lens placed in between produces an image magnified 4 times on the screen. Calculate the focal length & position of the lens. [3]
- (b) Glass is transparent yet glass powder looks opaque. When water is poured over it, it again becomes transparent. Why? [2]
- (c) Derive the lens maker's formula for a double convex lens. Mention the assumptions used. [3]

**Question 7**

- (a) Dispersion is produced by a prism but not by a slab while both are made of glass. [2] (b) Draw a ray diagram to show the working of a compound microscope. Define its magnifying power or angular magnification. [3]
- (c) The focal length of an achromatic combination of two lenses separated by a distance is 0.05 m. If the focal length of one lens is 0.03 m, find the focal length of the other & the distance of separation. [3]

**Section C**

(Answer any **two** questions)

**Question 8**

- (a) What is photoelectric effect? With the help of a suitable graph show the variation of photo current with:
  - (i) The intensity of incident radiation
  - (ii) Voltage applied between cathode & anode
  - (iii) Frequency of incident radiation. [4]
- (b) Define stopping potential. How is it related to the kinetic energy of photo electrons? [2]
- (c) Electrons move at right angles to a magnetic field of 0.03 T & enter it with a velocity of  $2 \times 10^7$  m/s. Find the value of  $e/m$ , given radius of the circular path to be 0.01764 m. [2]

**Question 9**

- (a) Draw energy band diagram of conductors, semiconductors and insulators. [3]
- (b) Derive the expression for the velocity of electron in the 1<sup>st</sup> orbit of H<sub>2</sub> atom & for the radius in the ground state. [3]
- (c) The half life period of a radioactive substance is 16 hrs. After how much time will 6.25% of the material remain undecayed? [2]

**Question 10**

- (a) Draw a labeled circuit diagram of a simple oscillator using transistor (n-p-n or p-n-p) in common emitter configuration. On what factors does the frequency of the oscillator depend? [3]
- (b) What is meant by doping a semiconductor? What are p-type semiconductors? Draw the circuit diagram of reverse biasing of a semiconductor diode. [3]
- (c) What is rectification? Why is half-wave rectifier not preferred? [2]

**[PHYSICAL CONSTANTS]**

Mass of electron ( $m_e$ )	= $9 \times 10^{-31}$ kg
Charge of electron (e)	= $1.6 \times 10^{-19}$ C
Plank's constant (h)	= $6.6 \times 10^{-34}$ Js
Permittivity of free space ( $\epsilon_0$ )	= $8.85 \times 10^{12}$ F/m
$1 / 4\pi\epsilon_0$	= $9 \times 10^9$ N m <sup>2</sup> C <sup>-2</sup>
Speed of light in vacuum (c)	= $3 \times 10^8$ m/s

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