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

STD- XII **MM-70**
DATE-26-09-12 **TIME - 3HRS**
SESSION:I

Attempt *all the* questions from Part-I & any two out of three questions from each of the sections of Part –II. The intended marks for questions or parts of questions are given in brackets [ ].

Part-I (20 marks)

All the questions are compulsory.

Question 1 **[20 x 1 =20]**

(A) Choose the alternative A,B,C or D for each of the questions given below:

(i) The current passing through a choke coil of 5 H is decreasing at a rate of 2 A/s. The emf developed across the coil is:
(A) – 10 V (B) 10 V (C) 2.5 V (D) – 2.5 V

(ii) What is the energy of a capacitor of capacitance 40 □F, when charged to 3 X 10^3 V
(A) 18 J (B) 180 J (C) 1800 J (D) 18000 J

(iii) When a ray of light enters the glass slab its wavelength
(A) increases (B) decreases (C) remains unchanged (D) None of above

(iv) Which of the following can be the dielectric constant K of an insulator?
(A) -1 (B) 0 (C) 0.5 (D) 5

(v) When The distance between two charged particles is halved, the force between them becomes
(A) ¼th (B) half (C) double (D) four times

(B) Answer all questions briefly:

(i) A galvanometer coil has a resistance of 12 □ and it shows full scale deflection for a current of 3.0 mA. How will you convert it into voltmeter of range 0 to 18 V?

(ii) A charged particle moving in a straight line enters a uniform magnetic field B at an arbitrary angle with the field direction. What will be its path?

(iii) The magnetic flux through a coil perpendicular to its plane and directed into the paper varies with time t (in second) according to the relation
□ = ($6t^2$ + 7t + 1) rnilli weber
Find magnitude of emf induced in the coil at t = 2s.

(iv)The refractive indices of glass, diamand and water are 15, 2.0 and 1.3 respectively. State with reason in which of these the speed of light will be maximum.

(v)A closed conducting loop moves normal to the electric field between the plates of a charged capacitor. Is any current induced in the loop when (i) it is wholly inside the capacitor (ii) partially outside the plates of the capacitor.

(vi) If, in Young's experiment, distance 'd' between the slits is kept smaller than the wavelength □ of light, the interference pattern will not be seen. Why?

(vii)A uniform electric field E exists between two charged plates. What will be the work done in moving a charge q along a closed rectangular path?

(viii)A wire is bent in the form of a circle of radius 10 cm. It is given a charge of 250 □C which spreads on it uniformly. What is the electric potential at the centre?

(ix) Draw a diagram to show how an image is produced by a pair of total reflecting prisms arranged in a periscope.

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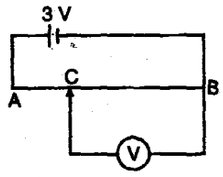
(x) Under what condition does a lens become invisible when immersed in a transparent liquid.

(xi) Define d-c current gain in common-emitter amplifier.

(xii) For observing Fraunhoffer diffraction from a single slit, what type of wavefront should be incident on the slit?

(xiii) Differentiate between a photon and a neutrino

(xiv) In Fig., AB is a potentiometer wire of length 100 cm. The cell of emf 3V has negligible internal resistance. What is the reading in voltmeter V. if BC is equal to 70 cm?



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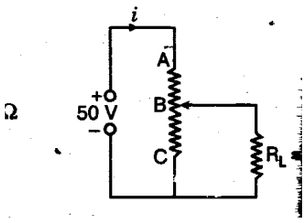
(xv) What is the cause of chromatic aberration?

Part-II (50 marks)
Section A
Answer any two out of three questions

Question 2

(a) A variable rheostat of 2 k□ is used to control the pd across a 500 □ load R_L. If the resistance is 500 □, what is p.d. across R_L ? If R_L is removed, what should be the resistance BC to get 40 □ between B and C? [3]



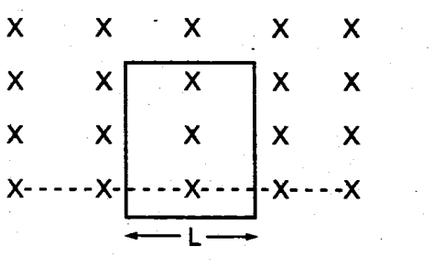
(b) The distance between the plates of a capacitor is d. A metal plate of thickness d/2 is placed between the plates. What will be the effect on the capacitance. Explain. [3]

(c) The current in an inductor is given by i = 5 + 16t where t is in s. The self-induced emf In it is 10 mV. Find: (1) self-induction (2) the energy stored in the inductor & the power Supplied to it at t = 1. [3]

Question 3

(a) A current is flowing through a thin straight metallic conductor of infinite length. Find expression for the magnetic field at a distance from it. [3]

(b) Figure shows a horizontal magnetic field which is uniform above the dotted line and is zero below it. A long rectangular, conducting loop of width L, mass m and resistance R is placed partly above and partly below the dotted line with the lower edge parallel to it. With what velocity should pushed downwards so that it may continue to fall without any acceleration? [3]



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(c) A copper wire of cross-sectional area 1.0 $(mm)^2$ carries a current of 0.21 A. Find the drift velocity of free electrons. The free electron density in copper is $8.4 \times 10^{28}\ m^{-3}$. [3]

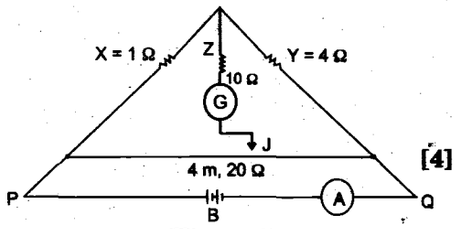
Question 4

(a) Derive the expression for potential at any point due to an electric dipole. [3]

(b) In the circuit shown below (Figure 6), PQ is a uniform metallic wire of length 4 m and resistance 20Q. Battery B has an emf of 1OV and internal resistance of 1. J is a jockey or slide contact. Resistance of the ammeter A and connecting wires it negligible.

(i) When the jockey J does not touch the wire PQ, what is the reading of ammeter A?

(ii) Where should the jockey J be pressed on the wire PQ so that the galvanometer G shows no deflection? [4]



(Figure 6)

(c) What is 'current density'? Write the vector equation connecting current density J with electric field intensity E, for an ohmic conductor. [3]

Section B

Answer any two out of three questions

Question 5

(a) Derive an expression for the angle of deviation of prism in terms of the refractive index and the angle of the prism. Give a proper diagram. [3]

(b) In Young's double slit experiment the slits are 0589 mm apart and the interference is observed on a screen placed at a distance of 100 cm from the slits. It is found that the 9th bright fringe is at a distance of 7.5 mm from the dark fringe which is second from the centre of the fringe pattern. Find the wavelength of the light used. [3]

(c) State how the resolving power of an astronomical telescope can be increased. [2]

Question 6

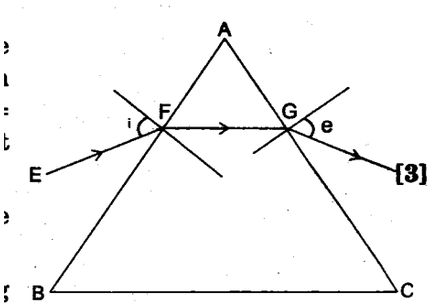
(a)) Using Huygen's principle prove laws of reflection. [3]

(b) Green light is incident at the polarising angle on a certain glass plate. The angle of refraction is 32°. What are: (i) polarising angle, (ii) the index of refraction of glass. [3]

(c) Explain the statement "Angular magnification of a compound microscope in normal use is 30□. [2]

Question 7

(a) A ray EF of monochromatic light is incident on the refracting surface AB of a regular glass prism (refractive index = 15) at an angle of incidence of i = 55□. If it emerges through the adjacent face AC, calculate the angle of emergence 'e'. [3]



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(b) The image of a small electric bulb fixed on the wall of a room is to be obtained on the opposite wall 30 m away by means of a convex lens. What is the maximum focal length of the required lens? [3]

(c) Explain dichroism. [2]

Section C

Answer any two out of three questions

Question 8

(a) Explain forward biasing and reverse biasing of p-n junction diode. [3]

(b) How much of 5.00 gram of polonium will decay in one year? The half -life of polonium is 138 days. ($\log_e$ 5.00 = 1.609, $e^{-0.223}$ = 0.800). [3]

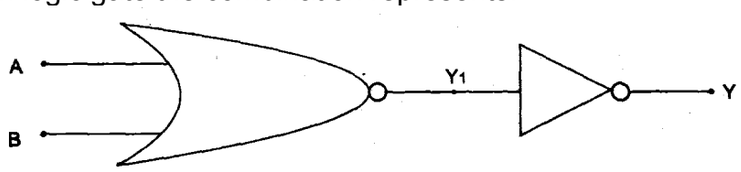
(c)Explain Radio Carbon Dating. [2]

Question 9

(a) Hydrogen atom in its ground state is excited by means of monochromatic radiation of wavelength 975 Å. How many lines are possible in the resulting emission spectrum? Calculate the longest wavelength amongst them. You may assume the ionization energy for hydrogen atom as 13.6 eV. [3]

(b) On an energy level diagram of hydrogen, show by a downward or an upward arrow, transition which results in:
(i) emission line of Baliner series.(ii) emission line of Lyman series.
(iii) absorption line of Lyman series. [3]

(c) The following combination of gates acts as a logic gate. With the help of a truth table, find out which logic gate the combination represents: [2]



Question 10

(a) Calculate the maximum frequency and minimum wavelength of X-rays produced in a tube maintained at 13.26 kV. [3]

(b) Calculate: (i) mass defect of Helium (He) nucleus and (ii) its binding energy in MeV.
Mass of proton = 1.007276 u Mass of neutron = 1.008665 u
Mass of the nucleus = 4.001506 u [3]

(c) Differentiate between analog & digital signals. [2]

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PHYSICAL CONSTANTS

Mass of electron (m_e)	= 9×10^{-31} kg
Charge of electron (e)	= 1.6×10^{-19} C
Plank's constant (h)	= 6.6×10^{-34} Js
Permittivity of free space (ε_o)	= 8.85×10^{12} F/m
$1 / 4\pi\varepsilon_o$	= 9×10^9 N m^2 C^{-2}
Speed of light in vacuum (c)	= 3×10^8 m/s
□$_0$ /4π	= 10^7 H/m.
1 eV	= 1.6×10^{-19} J
1 a.m.u. (u)	= 931 MeV