MAR THOMA RESIDENTIAL SCHOOL,TIRUVALLA

SECOND MODEL EXAMINATION

STD XII

PHYSICS

PAPER – 1

(THEORY)

(Maximum Marks: 70)

(Time allowed: Three hours)

(Candidates are allowed additional 15 minutes for only reading the paper.
They must NOT start writing during this time.)

All questions are compulsory.

This question paper is divided into 4 Sections, A, B, C and D as follows:

Section A

Question number 1 is of twelve marks. All parts of this question are compulsory.

Section B

Question numbers 2 to 12 carry 2 marks each with two questions having internal choice.

Section C

Question numbers 13 to 19 carry 3 marks each with two questions having internal choice.

Section D

Question numbers 20 to 22 are long-answer type questions and carry 5 marks each.
Each question has an internal choice.

The intended marks for questions are given in brackets [ ].

SECTION A

*Answer **all** questions*

Question 1 [5X1]

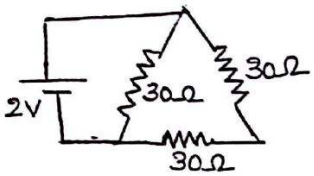
Choose the correct alternative

A (i) What is the ratio of electric fields at a given distance from an electric diploe at any point on its end-on position to its broad side-on position?

(a) 1:1 (b) 1:2 (c) 2:1 (d) 1:3

(ii) The current in the given circuit is

(a) $\frac{1}{45}$A (b) $\frac{1}{15}$A (c) $\frac{1}{10}$A (d) $\frac{1}{5}$A



(iii) Two thin lenses of focal lengths f_1 and f_2 are in coaxial contact. The power of the combinatior is (a) $\sqrt{f_1/f_2}$ (b)$\sqrt{f_2/f_1}$ (c) $(f_1+f_2)/f_1f_2$ (d) f_1+f_2/f_1

(iv) In photoelectric effect on metals, an increase in the frequency of incident radiation increases

(a) work function of the metal (b) threshold frequency

(c) velocity of the emitted electrons (d) rate of emission of electrons

(v) In common emitter amplifier, the current gain β is

(a) $\Delta I_c/\Delta I_E$ (b) $\Delta I_C/\Delta I_B$ (c) $\Delta I_E/\Delta I_B$ (d)$\Delta I_E/\Delta I_C$

B Answer the following questions briefly and to the point. [7X1]

(i) Name the particles which cannot be accelerated by a cyclotron or Van de Graff generator.

(ii) Write the vector form, the defining equation for the magnetic field $\vec{B}$ at a point.

(iii) An electric current of 0.25A flows in a loop of radius 2cm. Calculate magnetic dipole moment of the current loop.

(iv) How does resistance of a(i) conductor (ii) semi conductor changes with rise in temperature.

(v) In Young's double slit experiment with monochromatic light ,how is the fringe width affected, if blue light is replaced with the source of yellow light?

(vi) The total energy of an orbiting electron around the nucleus of an atom is always negative. What is the significance of this?

(vii) Draw the energy band diagram for an n-type semiconductor.

SECTION B

*Answer **all** questions*

Question 2

Explain with the help of a circuit diagram, how the value of unknown resistance can be determined using Wheat stone's bridge. (2)

Question 3

Derive the expression for electric potential at a point P at a distance $\vec{r}$ from charge +Q. (2)

OR

What is effect on electrostatic force, when a dielectric medium is introduced between two charges q_1 and q_2 at a separation ' r '? Write down the equation for electrostatic force. (2)

Question 4

Using Ampere circuital law, derive the expression for magnetic field intensity at a point due to a straight **current carrying conductor.** **(2)**

Question 5

What is the effect on the drift velocity of electrons when :

(i) length of the conductor is doubled.

(ii) potential difference is halved. (2)

Question 6

(i) It is necessary to use satellites for long distance TV transmission. Why?

(ii) To which part of the electromagnetic spectrum do the following belong.

1.Radiation having wavelength 30nm

2. Radiation having frequency 30MHz, (2)

Question 7

An astronomical telescope uses two lenses of powers 5D and 1D. If the final image of a distant object is formed at infinity, calculate the length of the telescope. (2)

Question 8

An object is placed in front of a concave mirror of focal length 15cm. It forms an image of size 3 times as that of the object. Find the position of the object with respect to the mirror. (2)

Question 9

(i) The phase difference between the light waves emerging from two slits is π radian. Will the central fringe be bright or dark.? Give reason. (2)

(ii) In young's double slit experiment the intensity of a bright fringe is I. What will be intensity at the same place if one slit is closed?

Question 10

(a) Explain the graphical variation of photoelectric current in a photo tube with

(i) voltage across the tube (ii) intensity of incident radiation (2)

OR

(b) The work function for sodium is 2.28 eV.

(i) What is the minimum energy for a quantum of radiation to cause photoelectric emission from a sodium surface?

(ii) Will light of wavelength $5000A^0$ eject photoelectrons from it? Explain.

Question 11

(i) Name a pn junction device used for detecting optical signals.

(ii) Draw a graph showing the variation current with applied voltage across this device. (2)

Question 12

Distinguish between analogue and digital signals. (2)

SECTION C

*Answer **all** questions*

Question 13

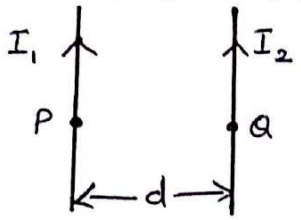
What is motional emf?

Derive the expression motional emf.

What happens to the strength of induced current, if velocity is increased? (3)

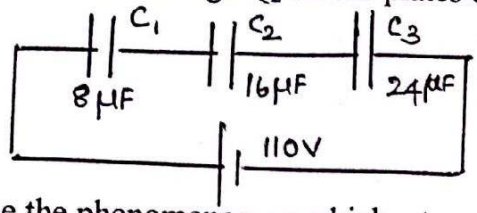
Question 14

Two very long conductors carrying currents I_1 and I_2 are separated by a distance 'd' as shown. Give the expression for magnetic fields B_{12} and B_{21} at points P and Q respectively produced by the currents. What are the directions of these fields? Define SI unit of current using this set up. (3)



Question 15

(i) Find total capacitance and charge Q_2 on the plates of the capacitor C_2 as shown : (3)



(ii) Name and define the phenomenon on which a transformer works?

Question 16

(a) (i) Derive an expression for the angle of diffraction for the first secondary minimum of the diffraction pattern of a single slit of width 'a' using light of wavelength λ.

(ii) Write the expression for angular width of the central maximum.

(iii) How does the angular width of central maximum change with increase in the width of the slit?. (3)

OR

(b) (i) State Brewster's law of polarisation.

(ii) Show that when a ray of light is incident on a transparent surface at the polarising angle, the reflected and refracted rays are at right angles to each other.

(iii) The refractive index of water is 4/3 and that of glass is 3/2. A beam of light travelling in water enters glass. For what angle of incidence the reflected light will be completely plane polarised? (3)

Question 17

(i) Obtain an expression for the kinetic energy of an electron in the orbit of hydrogen atom. Start from equating the electrostatic force with the centripetal force required and then use the quantisation condition for angular momentum.

(ii) Calculate the longest wavelength of the Lyman series of hydrogen spectrum. ($R= 1.097 \times 10^7 m^{-1}$). (3)

Question 18

(i) Define mass defect and binding energy of a nucleus.

(ii) Draw a graph showing the variation of binding energy per nucleon with the mass number of the nucleus.

(iii) The fission of Uranium 235 releases 200MeV of energy. Calculate the fission rate to produce a power of 320MW. (3)

Question 19

i) How are materials classified according to energy band diagram. Explain it with the help of separate diagrams.

ii) What is the need for modulation? (3)

SECTION D

*Answer **all** questions*

Question 20

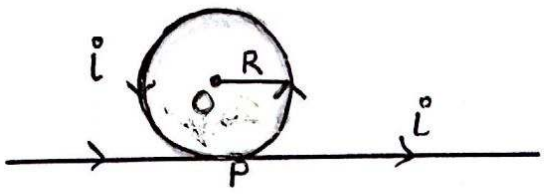
(i)An alternating voltage $v = v_0 \sin\omega t$ is applied to a circuit containing a capacitor and a resistor in series . Derive the expression for resultant voltage . State the angle of lead or lag of current with respect to the voltage . (2)

(ii) A resistance of 150 ohm and a capacitance of 15 μF are connected in series with an ac source . The peak value of current is 0.2A . Calculate the average power consumed in the circuit ?

If the capacitor is removed but the current is kept the same , what is the average power consumed in the resistor alone ? (3)

OR

(i) A long wire is bent as shown . Find the magnitude and direction of the magnetic field at the centre 'O' of the circular part , if a current of 'i' ampere is passed through the wire . The different parts of the wire do not touch each other at p. (3)

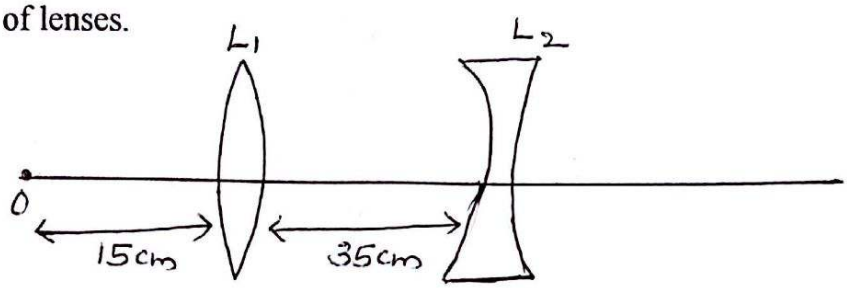


(ii) Find the voltmeter reading , if the resistance of the voltmeter is 400 ohm. (2)

Question 21

(a) (i) A point object is kept at the principal axis of a convex spherical refracting surface of radius of curvature. With the help of a ray diagram derive the relation connecting its image distance(v) , object distance (u) and the radius (R).

(ii) An illuminated object O is kept at 20 cm from a this convex lens L_1 of focal length 15 cm as shown in the figure A the diverging lens L_2 of focal length 25 cm is kept exactly with the first lens and 35 cm from it. Find the position of the final image formed by the combination of lenses.



b)i) Draw a ray diagram to show image formed by an astronomical telescope in normal use. Hence derive an expression for angular magnification.

ii) The focal lengths of the objective and eye piece of compound microscope are 1cm and 5cm respectively .An object placed at a distance of 1.1cm from the objective has its final image formed at infinity. Find the magnifying power and distance between the lenses. (

Question 22

A) (i) With the help of a circuit diagram explain the following for a CE transistor.

1. Input characteristics
2. Output characteristics
3. Transfer characteristics.

(ii) A common emitter amplifier has current gain of 50. If the collector resistance is 5Kohm and the input resistance is 1Kohm ,find the voltage gain of the amplifier.

OR

B)i) Draw the V-I characteristics of a p-n junction diode.

ii)Explain, what do you mean by knee voltage and break down voltage.

iii)Write the truth table of the following logic gate. (5)