**SEETA HIGH SCHOOL GREEN CAMPUS WORKSHOP S.6 QUESTIONS 2024.**

**PAPER ONE P510/1**

**SECTION A**

1. a) Define the following terms;
2. Speed. [1]
3. Uniform acceleration. [1]

(b) Derive the equation. [3]

(c) Draw, velocity-time and displacement-time graphs for a body moving with,

(i) Constant velocity. [2]

(ii) Constant acceleration. [2]

(d) Two balls of masses 3.0 kg and 2.0 kg move in opposite direction with respective velocities of 5.0 ms-1 4.0 ms-1. If the balls stick and move together after collision, find

(i) The velocity of the balls after collision. [2]

(ii) The loss in kinetic energy of the 3.0 kg mass. [3]

(e) (i) State the laws of dynamic friction. [3]

(ii) Use the molecular theory of matter to explain the laws of friction. [3]

**2**. (a) Define the following terms;

(i)Moment of a force and, (ii) Torque of a couple.

(iii) Centre of gravity. [3]

(b) (i) State the conditions for a rigid body to be in mechanical equilibrium. [2]

(ii) Describe an experiment to determine the center of gravity of an irregularly shaped lamina. [6]

(c) A uniform beam AB of mass 2.0 kg is hinged on a vertical wall AC and suspended by an inextensible string BC as shown in the diagram below.

B

C

Wall

110°

1.56 m

40°

A

Find;

1. The tension in the string. [5]
2. The reaction of the wall at A. [4]

**3** (a) (i) Define moment of inertia and state its units. [2]

(ii) Derive an expression for rotational kinetic energy of a body about an axis in terms of its moment of inertia **I**, mass **m** and distance **r** from the axis of rotation. [4]

(b) A weightless rod of length 1.0 m has four masses each of 10.0g attached to it at distances of 0.0 cm, 25.0 cm, 75.0 cm and 100.0 cm from one end respectively. The rod is made to rotate in a horizontal plane about a vertical axis at its center. If the rod makes 8.0 rev/s, find;

(i) Rotational kinetic energy of the system. [2]

(ii) Moment of inertia for the system. [3]

(c) (i) Draw a sketch diagram of a car moving round a circular track on level ground and indicate the forces acting on the car. [3]

(ii) If the track is of radius r, derive an expression for the maximum speed with which the car can move round the track without overturning. 4]

(d) Explain the advantage of banking a circular track for racing cars. [2]

**4.** (a) (i) State Bernoulli’s principle. [1]

(ii) Explain why it is dangerous to stand close to a railway line on which a fast moving train is passing. [3]

(b) (i) Explain the temperature dependence of viscosity of a liquid. [3]

(ii) Water of negligible viscosity flows steadily through a horizontal pipe of varying cross-sectional area. At a point A of cross-sectional area 10cm2, the velocity is 0.2ms– 1. What is the pressure difference between A and B if the cross section area of point B is 2.5cm2? (Given that the density of water = 103kgm – 3 ) [4]

(c) (i) Explain the origin of surface tension. [4]

(iii) Describe an experiment to measure the surface tension of a liquid by the capillary tube method.

**SECTION B**

**5.** (a) State any two ways in which real gases differ from an ideal gas. [2]

(b) Using the same axes, sketch pressure versus volume graphs for a real gas;

(i) **Above** the critical temperature, **at the** critical temperature and **below** the critical temperature. [3]

(ii) Indicate in your sketch in (i) above, the different phases of the gas. [2]

(c) An ideal gas at a pressure of 2.0 × 105 Pa occupies a volume of 3.0 × 10-3 Pa at 50.2˚C. The gas expands adiabatically to a final pressure of 1.5 × 107 Pa. The ratio of the specific heat capacity at constant pressure to that at constant volume is 1.40.

Calculate

1. The number of moles of the gas [2]
2. The final volume of the gas. [3]
3. The final temperature of the gas. [3]

(c) (i) State Dalton’s law of partial pressures. [1]

(ii) Two metallic bulbs of volumes 3.0m3 and 8.0 m3 respectively are joined together by a narrow tube of negligible volume. The bulbs contain air at a temperature 23˚C and pressure 1.01 × 105 Pa.

Calculate the resulting pressure in the bulbs when the temperature of the smaller bulb is raised to 100˚ C and that of the larger bulb lowered to 0˚ C. State any assumption made. [4]

**6**. (a) (i) State the thermometric property used in the constant-volume gas thermometer 1]

(ii) Give two characteristics of a good thermometric property. [2]

(b) (i) Describe the steps taken to set up a Celsius scale of temperature for a mercury-in-glass thermometer. [4]

(ii) State four disadvantages of mercury-in-glass thermometer. [2]

(c) Describe with the aid of a labelled diagram the operation of an optical pyrometer. [6]

(d) The brake linings of the wheels of a car of mass 800 kg have a total mass of 4.8 kg and are made of a material of specific heat capacity 1200 J kg-1 K-1. If the car is at 15 ms-1 and is brought to rest by applying the brakes, calculate the maximum possible temperature rise of the brake linings. [4]

**7.** (a) (i) Define specific latent heat of vaporization. [1]

(ii) With the aid of a well labelled diagram, describe the accurate method of determining the specific latent heat of vaporization of water. [5]

(b) Warm water and cold water flow are into a bath tab at the same time. Warm water flows at a rate of 3.5 kg min-1 at a temperature of 60ºC, while cold water flows out at a rate of 4.2 kg min-1. When the water has been flowing for 40.0 seconds, the temperature of the water in the tab is found to be 35.0ºC. If the water in the tab loses heat at an average rate of 100W, find,

(i) The mass of water in the tab after 40.0 seconds. [2]

(ii) The temperature of the cold water. [4]

(c) Define thermal conductivity of a material and state its units. [2]

(d) A house has a concrete floor of area 40.0m2 and thickness 10.0cm. The temperature inside the room is 25ºC while that just below the concrete is 20ºC. If 1.02×105 Joules of heat are lost through the concrete every minute, find;

(i) The conductivity of concrete. [3]

(ii) The thickness of extra concrete needed to reduce the rate of heat flow through the concrete by 40%. [3]

**SECTION C**

**8.** (a) State any four properties of Cathode rays. [2]

(b) (i) Define specific charge of an electron and state its units. [2]

(ii) With use of a labeled diagram, describe Thomson’s experiment to determine the specific charge of an electron. [6]

(c) Electrons are accelerated through a high potential difference and enter mid-way between two parallel plates with a velocity parallel to the plates. The plates are 15.0cm long and separated by 12.0mm. The electrons are deflected through 2.0cm on a screen placed 12.5cm beyond the plates when a potential difference of 960V is connected across the plates. Find

(i) The velocity of the electrons as they emerge from the region between the plates. [4]

(ii) the voltage used to accelerate the electrons before they enter the region between the plates. [2]

(d) In Millikan’s oil drop experiment an oil drop of radius 6.2×10-6m and density 880kgm-3 was observed to fall through a distance of 6.25×10-1cms-1, when no potential difference was put across the plates. When a potential difference of 690V was applied between the plates, the same drop was seen to rise steadily at a speed of 7.25×10-2cms-1. If the distance between the plates is 1.5cm and the coefficient of viscosity of air is 1.8×10-7Ns-1kg2, find the charge on the oil drop. [4]

**9**. (a) Define a photon? [1]

(b) (i) With the aid of a diagram explain how X-rays are produced in an X-ray tube. [5]

(ii) State the energy changes that take place in the production of X-rays in an X-ray tube. [2]

(c) In an X-ray tube, the electrons strike the target with a velocity of 3.75×107ms-1 after travelling a distance of 5.0cm from the cathode. If a current of 10mA flows through the tube, find the

(i) tube voltage. [2]

(ii) number of electrons striking the target per second. [2]

(iii) number of electrons within a space of 1 cm length between the anode and the cathode. [5]

(d) Briefly explain one medical application of X-rays. [3]

**10**. (a) Define the following terms as used in radioactivity.

(i) Isotopes (ii) Half-life, and (iii) Mass number. [3]

(b) With use of a labeled diagram describe how a Geiger Muller tube is used to detect radiation from a radioactive material. [6]

(c) The radioactive Strontium decays by emission of beta particles to form an element.

(i) Write the equation representing the decay process above. [1]

(ii) If the half-life of  is 28.8 years, determine the current activity of a sample of 2.5*µ*g of obtained 15 years ago. [5]

(d) (i) State two industrial uses and two health hazards of radioactivity. [2]

(ii) Given the equation N = Noe-λt, show that half-life. [3]

**PAPER TWO P510/2 SEMINAR 2024**

**SECTION A**

1. (a) What is meant by the following as applied to refraction through a prism?

(i) **R*efracting angle.*** (1)

(ii) ***Deviation.*** (1)

(b) (i) Briefly describe the adjustments that have to be made before using the prism spectrometer.(3)

(ii) Describe an experiment to determine the refractive index of glass in form of a prism of known refracting angle, using the prism spectrometer. (6)

(c) Show that when a ray of light passes through different media separated by plane boundaries

***n sin i* = constant**

Where ***n*** is the absolute refractive index of a medium and ***i*** is the angle made by the ray with the normal in the medium. (4)

(d) The figure below shows a liquid of refractive index 1.33 enclosed by glass of uniform thickness. A ray of light, incident on face PQ at an angle of incidence, θ, emerges through face QR.

A

θ

Q

P

R

As the angle θ is reduced, suddenly the emergent ray disappears when

θ = 16o.Find the angle A. (5)

1. (a) (i) Draw a ray diagram to show how a concave mirror forms a real image of a finite size object. . (2)

(ii) From the diagram in (i) derive the relation, where *u, v* and *f* are object distance, image distance and focal length of the mirror respectively. . (4)

(b) Describe an experiment to determine focal length of a convex mirror using a plane mirror. (4)

(c) (i) Define the term refractive index of a material [1] (ii) Explain with the help of a diagram, why a pond of clear water looks shallower than it actually is.

(d) In the diagram shows a cross section of an optical fibre used for communication.

**40°**

**80°**

**A**

**B**

**Core**

**Material of refractive index 1.42**

1. Explain why light is reflected at A? [2]
2. The normal at A and B meet at an angle of 40° and light grazes the boundary between the media at B. Find the refractive index of the core. [4]

(b) A lens forms a sharp image of height h1 on a fixed screen. As the lens is moved towards the screen another sharp image of height h2, of the same object, is formed on the screen. If the object position remained the same in both cases, obtain an expression for the height of the object. (3)

**SECTION B**

1. (a) What is meant by

(i) ***Wavelength*** of a wave. (1)

(ii) ***pitch*** of a musical note (1)

(b) (i) A source of sound of frequency f, is moving with velocity us away from an observer who is moving with velocity uo in the same direction. If the velocity of sound is V, derive an expression for the frequency of sound heard by the observer. (5)

(ii) Explain what happens to the pitch of the sound heard by the observer in (b)(i) above when the observer moves faster than the source (2)

(c) State the principle of superposition of waves (1)

1. The equation of a stationary wave is given by. (i) Write the equations of the progressive waves which combine to form the above stationary wave (1) (ii) Determine the distance between antinodes. (3) c) i) What is meant by the term ‘beats’ (3)

ii) Derive an expression for the beat frequency when a note of frequencies f1 and f2 are sounded together (3)

iii) Beats are produced by a plucked stretched wire and a resonance tube closed at one end, each is vibrating at its fundamental note. The air column has a length of 0.168m and end correction 0.012m. The wire has a vibrating length of 0.270m and is under a tension of 100N. The mass of the wire is 4.0 x 10-4kg. If the of sound in air is 350ms-1. Calculate the frequency of the beats heard (4) c) Describe an experiment to show variation of frequency of a wire with tension. (5)

1. (a) (i) What is meant by interference of waves? (2)

(ii) State the conditions necessary for the observation of interference pattern. (2)

(iii) Describe how interference can be used to test for the flatness of a surface. (3)

(b) Describe with the aid of a labelled diagram, how the wavelength of monochromatic light is measured using Young’s double-slit method. (5)

(c) Two microscope slides are in contact at one end and are separated by a thin piece of paper at the other end. Monochromatic light is directed normally on the wedge.

(i) What type of fringes will be observed? (2)

(ii) Explain what will be observed if a liquid is introduced between the slides. (2)

(d) When monochromatic light of wavelength 5.0 x 10-7m is incident normally on a transmission grating, the second order diffraction line is observed at an angle of 270. How many lines per centimetre does the grating have?

**SECTION C**

1. (a)(i) Define magnetic field

ii) Sketch magnetic field patterns around solenoid carrying current I. Indicate poles and hence write an expression for magnetic flux density at the Centre of the solenoid (3marks)

1. A conductor carrying current I is placed in magnetic field of density B. The conductor experiences a force F
2. Write down the formula of finding force F (1mark)
3. Explain the origin of this force (3marks)

c)(i) What is meant by the term magnetic torque (1mark)

(ii) A rectangular coil of length L carrying current I is placed in magnetic field of flux density B such that its plane makes and angle, ϴ with the field. Derive and expression of the torque on the coil (4marks)

d) A narrow vertical rectangular coil suspended from the middle of its upper side with its plane parallel to a uniform horizontal magnetic field of 0.02T. The coil has 10turn and the lengths of its vertical and horizontal sides are 0.1m and 0.05m respectively. Calculate the torque on the coil when current of 5A is passed into it. (4marks)

e) With aid of a diagram explain the origin of hall voltage (4marks)

1. (a)(i) State the laws of electromagnetic induction (2marks)

ii) With aid of illustrations describe a simple experiment to demonstrate Lens law (4marks)

b) Circular rotating disc is placed in a magnetic field with its plane perpendicular to the magnetic field derive an expression of EMF E induced in the disc (4marks

c) (i) What is meant by eddy currents (2marks)

ii) Describe one application of Eddy currents (3marks)

d) A search coil of average cross sectional area of 3.0cm2 has 400turns and the circuit has a total resistance of 200Ω. It is placed in a magnetic field of 2.5X 10-3 T so as to produce the maximum flux change. Find the magnitude of charge induced in the coil (3marks)

1. (a) (i) Define ***root mean square*** value of an alternating current. [1] (ii) Derive an expression for the root mean square value of an alternating current. [3]

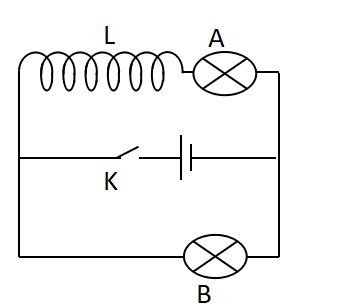
(b) (i) With the aid of a diagram, describe the structure and action of the attraction type of a moving iron ammeter. [4]

(ii) State two advantages of a moving iron ammeter over moving coil ammeter [2]

(c) An inductor of inductance L and negligible resistance is connected across a source of alternating voltage, V = Vo cos2πft and variable frequency f.

(i) Find an expression for the reactance. (3marks) (ii) Draw on the same graph the relationship between voltage and current with time across the inductor. (2marks)

(c) Two identical bulbs **A and B** are connected to a coil, **L**, of negligible resistance as shown in the diagram in **figure 3**.



Explain the observations when the switch;

(i) K is closed. (2)

(ii) K is opened. (2)

(iii) Soft iron rod is inserted in the coil and K closed. (2)

(d) A capacitance of **12.5 μF** and resistance **10 Ω** in series with a **20 Ω** resistor is connected to an alternating voltage, **V = (20√2) cos 2000 t, volts**. Find:

(i) the power dissipated in the circuit. (4)

(ii) the potential difference across the capacitor. (2)

(iii) the phase angle between the current and the applied voltage. (2)

**SECTION D**

1. (a)(i) Define the terms *electric field intensity* and *electric potential at a point*. [2]

(ii) Derive the relationship between the terms in (i) above. [3]

b) Describe the mechanism of charging by rubbing [3]

(c) Charges of **-1μC**, **+√8μC** and **+1μC** are placed at the corners of a square of side 20 cm as shown below;

20cm

**+√8μC +1μC**

20cm

**-1μC**

P

Calculate the:

(i) Electric potential at P (4)

(ii) Electric field intensity at P (5)

d) What is meant by corona discharge? [3]

1. (a)(i) Define **capacitance** of a capacitor (01mark)

(ii) Derive an expression for the energy stored in a capacitor of capacitance C charged to a P.d, V.(3)

* + 1. (i) Explain the effect of placing an insulator between the plates of a charged capacitor. (4)

(ii) State two physical properties desirable in a material to be used as a dielectric in a capacitor.(2)

* + 1. Describe how the unknown capacitance of a capacitor can be determined using a ballistic galvanometer.
    2. A capacitor of capacitance 5 μF is charged to a p.d. of 52 V with the aid of a battery. The battery is then removed and the capacitor is connected to an uncharged capacitor of capacitance 8μF. Calculate:

(i) the final p.d., V across the combination. (2)

(ii) the energy stored before and after connecting the two capacitors. (3)

(iii) Account for the difference in the quantities of energy calculated. (1)

10. (a)(i) Define the following terms;  and internal resistance. (3marks)

ii) Explain why the conductor becomes warm when current is passed through it. (3mrks)

b)(i)A cell of  , and internal resistance, drives a current through resistor of resistance  connected in series with it. Derive an expression for the efficiency of the circuit. (4 marks)

ii) You are provided with the following apparatus, ammeter, voltmeter, dry cell, switch, resistance wire, metre rule and connecting wires. Explain using the above apparatus an experiment to determine the resistivity of the wire. (5marks)

(d) In the circuit diagram shown below, AB is a slide wire of length 1.0 m and resistance 10 Ω. X is a driver cell of emf 3.0 V and negligible internal resistance. Y is a cell of emf 2.2 V and internal resistance 1.0Ω

A

B

X 3.0V

Y

e

d

f

2.2V, 1Ω

2Ω

R1

R2

When the centre-zero galvanometer is connected in turns to points **e** and **f**, the balance lengths obtained are 45.0 cm and 80.0 cm respectively. Calculate the:

(i) Current flowing through R1. (3)

(ii) Resistances of R1 and R2. (2)