General Instrutions

1. *Attempt **all** questions from **Section I** and **any four** questions from **Section II**.*
2. *The intended marks for questions or parts of questions are given in brackets.*

SECTION I (40 Marks)
Attempt all questions from this Section.

Question 1
(a) [4]

   i.   A body P has a mass of 20 kg and is moving with a velocity of 5 m/s. Another body Q has a mass of 5 kg and is moving with a velocity of 20 m/s. Calculate:
        (1) The ratio of the momentum of P and Q.
        (2) The kinetic energy of P in S.I. units.
   ii. Why is the mechanical advantage of a lever of the third order is always less than l? Give one example of this class of lever.

(b) [4]

   i.   Will a body weigh more in air or in vacuum when weighed with a spring balance? Give a reason for your answer.
   ii. A test tube loaded with lead-shots floats to the mark X in water. The test tube alongwith lead shots weighs 25 g. When the test tube is floated in brine, 5g of lead shots were added to make it float upto level X. Find the relative density of brine.

(c) [4]

   i.   It takes a much longer time to boil off (change to steam) a certain quantity of water, rather than to bring it to its boiling point from room temperature, say 25°C. Explain the reason for this.
   ii. A hot solid of mass 60 g at 100°C. Is placed in 100g of water at 18°C. The final steady temperature recorded is 20°C. Find the specific heat capacity of the solid.

(d) [4]

   i.   The diagram shows a point source of light S, a convex lens L and a plane mirror M. These are placed such that rays of light, from S return to it after reflection from M.
        1. What is the distance OS called?
        2. To which point (left of S, on S, or right of S) will the rays return, if M is moved

to the left and brought in contact with L?
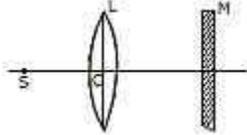
ii.   Fill in the blanks to complete the following sentences:
1. A piece of red-cloth appears red in white light because it .... blue and green and .... only red.
2. Blue + ..., = cyan. Green + Magenta = ...

(e) [4]

i.   Where does the far point of a normal eye lie? Where does it lie in a person suffering from myopia?
ii.   Draw a ray diagram to show how the defect of myopia can be remedied by f using a suitable lens.

(f) [4]

i.   Two friends were playing on their identical guitars whose strings were adjusted to give notes of the same pitch. Will the quality of the two notes be the same? Give a reason for your answer.
ii.   Give the relation wavelength, time-period and wave-velocity of a wave motion.

(g) [4]

i.   Name the material used for making a fuse wire. State two properties of the material of fuse-wire which make it suitable for use.
ii.   Calculate the electrical energy in SI units consumed by a 100 W bulb and a 60 W fan connected in parallel for 5 minutes.

(h) [4]

i.   State two characteristics of a primary coil of a step-up transformer when compared to the secondary coil.
ii.   With about a D.C. motor, state: 1. The energy change that takes place. 2 . The principle on which it operates.

(i) [4]

i.   What is a 'photoelectric effect'? On what property of incident radiation does it depend to obtain photoelectric current?

ii.   A radioactive element
      A
      Z X

first emits a β-particle and then an α-particle and the resulting nucleus can be represented by
P
Q Y

What are the values of P and Q in terms of A and Z?

(j) [4]

i.   What is nuclear fusion? Name the particle which causes nuclear fission of U-235.
ii.   State what is meant by: 1. Black holes. 2. The milky way.

SECTION II (40 marks)
Attempt any four questions from this Section.

Question 2
(a) In the diagram of a stationary wheel barrow, the centre of gravity is at A. The wheel and the leg are in contact with the ground. The horizontal distance between A and F is 50 cm and that between B and F is 150 cm.
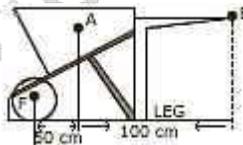
i.   What is the direction of the force acting at A? Name the force. [2]
ii.   What is the direction of the minimum force at B to keep the leg off the ground? What is this force called? [2]
iii. The weight of the wheel barrow is 15 kgf and it holds sand of weight 60 kgf Calculate the minimum force required to keep the leg off the ground. [3]

(b) An engine can pump 30,000 litres of water to a vertical height of 45 metres in 10 minutes (g = 9·8 m/s^2). Calculate the work done by the machine and its power [density of water = 103 kg/m3, 1000 litres = 1m^3]. [3]

Question 3
(a) [4]

i.   Draw a labelled diagram of the apparatus you would use to determine the specdic latent heat of vaporisation of steam by the method of mixtures.
ii. State two precautions you would take, while performing the experiment with the apparatus.

(b) Calculate the mass of steam at 100°C that must be passed into 8.4 kg. of water at 30°C to raise the temperature of water to 80°C. [Sp. heat capacity of water Q = 4.2 J/g°C, Sp. latent heat of vaporisation of steam = 2268 J/g.] [4]

(c) Why do the surroundings become pleasantly warm when freezing starts in cold countries? [2]

Question 4 [4]

(a) Draw a ray diagram to illustrate the action of a convergent lens as a reading lens or a magnifying glass.

(b) A prism deviates a monochromatic ray of light through an angle 'δ' when the angle of incidence at the surface of the prism is 'i'.

i.   Draw a graph showing the variation of 'δ' with 'i'. On Your graph show the angle of minimum deviation. [2]
ii. What is the relation between the angle of incidence and the angle of emergence when the ray suffers minimum deviation. [1]

(c)

i.   Two isosceles right-angled prisms are arranged as shown in the figure. Copy the diagram and complete the path of the ray AB along which it passes through the prisms and comes out. [1]
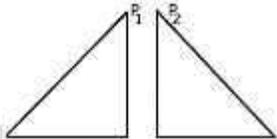
ii. Name the phenomenon being displayed by the path of the ray in the diagram. [2]

Question 5
(a) The rear view mirror of a motor bike starts vibrating violently at some particular speed of the motor bike. [4]

i.   Why does this happen?
ii.   What is the name of the phenomenon taking place?
iii. What could be done to stop the violent vibrations?

(b) A sound wave of wavelength 0.332 m has a time period of 10^{-3} s. If the time period is decreased to 10^{-4} s; calculate the wavelength and frequency of the new wave. [3]

(c) [3]

   i.   Define the terms: Amplitude and frequency for sound waves.
   ii.   Name the subjective property of sound related to its frequency and of light related to its wavelength.

Question 6
(a) [3]

   i.   Under what circumstances does one get an electric shock from an electric gadget?
   ii.   What is meant by earthing of an electrical appliance? How does earthing offer protection?

(b) In the figure shown calculate: [5]
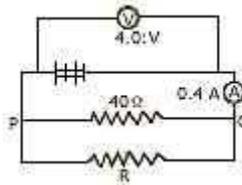
   i.   The value of the combined resitances of 40 ohm and R, using the readings of the two meters.
   ii.   The value of R.
   iii. The current flowing through R.

(c) State how a galvanometer can be converted to? [2]

   i.   A voltmeter.
   ii.   An ammeter.

Question 7
(a)

   i.   What is a diode? Why is a diode called a valve? [2]
   ii.   Draw a circuit diagram to show a diode used for half wave rectification. [2]

(b) [3]

   i.   What is radioactivity?

ii. A radioactive substance is oxidized. What change would you expect to take place in the nature of its radioactivity? Give a reason for your answer.

(c) [3]

i. What are beta rays and gamma rays?
ii. Explain briefly what change takes place within the nuclei, when beta particles are emitted from a radioactive substance?