ASSIGNMENT QUESTIONS – PART – B

ACOUSTICS AND ULTRASONICS

I a) What is the magnetostrictive effect? Explain the construction and working of magnetostriction oscillator.

b) Explain in detail how the ultrasonic pulse technique is used for non-destructive testing for materials.

II a) What is inverse piezo-electric effect?

b) Describe the piezo-electric method of producing ultrasonic waves with neat diagram

c) An ultrasonic generator consists of a quartz plate of thickness 0.7 mm and density 2800 kg/m^3. Find the fundamental frequency of ultrasonic waves if the Young's modulus of quartz is 8.8 x 10^{10} N / m^2.

III a) What is acoustic grating?

b) How it is used to find the velocity of ultrasonic waves in liquid medium?

c) A quartz crystal in an ultrasonic interferometer produces stationary waves of frequency 1.5 MHz. If the distance between 6 consecutive nodes is 2.75 mm ,find the velocity of the ultrasonic wave.

IV a) Explain sonogram.

b) Explain the three modes of display systems used in ultrasonic imaging device.

V Derive Sabine 's formula for reverberation time.

VI a) Using the expression of reverberation time, determine the absorption coefficient of a material.

b) Write an essay on the factors affecting architectural acoustics. Give remedies.

CRYSTALLOGRAPHY

I a) Explain the characteristics of simple cubic crystal.

b) Describe the solution growth of crystal and also explain the vapour growth technique of growing crystals.

II a) Explain the characteristics of an unit cell in Body centred cubic crystal.

b) Explain the Czochralski method of growing crystals .

III a) Explain the characteristics of face centred cubic crystal.

b) Metallic iron changes from BCC to FCC form at 910^{o}C. At this temperature, the atomic radii of the iron atoms in the two structures are 0.1258 nm and 0.1292 nm respectively. Calculate the volume change in percentage during this structural change.

IV a) What are Miler Indices?

b) Give the procedure for finding Miller indices of crystal planes.

c) Show that for a cubic lattice the distance between two successive plane is given by $d = a/\sqrt{h^2+k^2+l^2}$.

d) List out the important features of Miller indices

e) Calculate the interplanar spacing for (101) and (221) planes in a simple cubic lattice whose lattice constant is 0.42 nm.

V a) Describe the structure of HCP crystal.

b) Obtain the relation between c and a and hence calculate the packing factor.

c) Magnesium has HCP structure. The radius of magnesium atom is 0.1605 nm, calculate the volume of the unit cell of magnesium.

VI a) Explain diamond structure and obtain its atomic packing factor.

b) Describe Bridgman method of growing crystals.

PROPERTIES OF MATTER AND THRMAL PHYSICS

I a) Derive an expression for the elevation at the centre of a beam which is loaded at both ends. Describe an experiment to determine Young's modulus of a beam by uniform bending

b) Determine Young's modulus of the material of a rod, if it is bent uniformly over two knife edges separated by a distance of 0.6 m and loads of 2.5 kg are hung at 0.18 m away from the knife edges. The breadth and thickness of the rod is 0.025 m and 0.005 m respectively. The elevation at the middle of the rod is 0.007 m.

II a) Derive an expression for the depression at the free end of a cantilever due to load. Describe an experiment to determine Young's modulus of the cantilever .

b) Calculate the Young's modulus if the length of cantilever beam is 1 m which is suspended with a load of 150 gm. The depression is found to be 4 cm. The thickness of the beam is 5 mm and breadth of the beam is 3 cm.

III a) Draw stress strain diagram and discuss the factors affecting the elasticity of a material.

b) Explain the three types of elastic modulii and derive the relation between them.

IV a) Derive an expression for the internal bending moment of a beam in terms of radius of curvature.

b) The modulus of rigidity and poisson's ratio of the material of a wire are 2.87×10^{10} Nm^{-2} and 0.379 respectively. Find the value of Young's modulus of the material of the wire.

V a) Describe with relevant theory the method of determining the coefficient of thermal conductivity of a bad conductor by Lee's method.

b) Explain the experimental method used to determine the thermal conductivity of rubber based on the principle of radial flow of heat

VI a) Describe the conduction of heat through compound medium kept in parallel and in series.

b) A composite metal bar of uniform cross-section is made up of 0.25 m of metal A and 0.1 m of metal B and each being in perfect thermal contact with the adjoining part. There is no heat loss at the sides. The thermal conductivities of metals A and B are 920 and 120 S.I. units respectively. The end A is maintained at 100^oC and the end B is maintained at 24 ^oC. Calculate the temperature at A- B junction.

VII a) Describe the rectilinear flow of heat along an uniform bar.

b)A 30 cm length of iron rod is heated at one end to 100^0C, while the other end is kept at a temperature of 35^oC. The area of cross section of the iron rod is 0.725 cm^2. Assume that the iron rod is thermally insulated. Calculate the amount of heat conducted through the rod in 8 minutes along the rod. Given the thermal conductivity of iron K = 62 $Wm^{-1}K^{-1}$.

VIII a) State Newton's law of cooling .Derive its derivation and describe its experimental method.

b) A body takes 5 minutes to cool from 75^oC to 50^oC. Determine the time required for it to cool from 50^oC to 25^oC if the surrounding temperature is 15^oC.