B. N. Bandodkar college of science, Thane-400 601.

F.Y.B.Sc A.T.K.T AUG. 2011

Physics - I

Duration : 3 hrs **Total Marks : 90**

N.B. : 1) All questions are compulsory

2) Figures to the right indicate full marks.

3) Symbols have their usual meanings.

4) Use of non-programmable calculator is allowed.

Section-I

Q.1. a) Attempt any **ONE.** **8**

1) Show that for a homogeneous isotropic material $Y=3K(1-2\sigma)$.
2) State and prove Bernoulli's theorem.

b) A weight of 100N hangs from a string tied to the two other strings attached to a fixed support. The two strings make angles of 40^0 and 50^0 with the horizontal. Find the tensions in all three strings. **4**

c) Define Poisson's ratio. Show that the theoretical values of Poisson's ratio are -1 to 0.5. **3**

Q.2. a) Attempt any **ONE.** **8**

1) Treating air as a perfect gas, derive an expression for the change of atmospheric temperature with height above the sea level.
2) Show that the first law of thermodynamics can be written as

$$dQ = C_p\, dT + \left[\left(\frac{\partial H}{\partial P}\right)_T - V\right] dP$$

b) Define Enthalpy. Is it a state function? Show that **4**

$$C_P = \left(\frac{\partial H}{\partial T}\right)_P$$

c) Calculate the temperature drop over 1km of the atmospheric if r = 1.4 for air and average molecular weight of air is 0.029 kg/mole. R= 8.4J/mole K and g= 9.8 m/s^2. **3**

Q.3. a) Attempt any **ONE.** **8**

1) Obtain an expression for a longitudinal wave through a rod and show that it is independent of the applied force and cross sectional area of the rod.
2) What are ultrasonic? Describe any two methods for their production.

b) Define reverberation time. State Sabine's formula for reverberation time. **4**

c) State the properties of ultrasonic waves. **3**

Section -II

Q.4. **a)** Attempt any **ONE.** **8**

1) Discuss the composition of two perpendicular simple harmonic motions of the same period and show that the path of the resultant motion, in general, is an inclined ellipse.
2) Set up the equation of motion for rocket motion and derive an expression for the maximum velocity attained by a rocket.

b) Find the centre of mass of a uniform thin circular ring. **4**

c) A rocket has exhaust velocity of 2500 m/s. At what rate must it burn fuel to develop its thrust of 10^4 Newton. **3**

Q.5. **a)** Attempt any **ONE.** **8**

1) Two thin lenses $L_1$and L_2 having focal lengths F_1 and F_2 respectively are separated by distance d. Obtain the expression for equivalent focal length of combination of lenses. Draw the necessary ray diagram.

2) Give theory of interference in thin film. Derive an expression for the optical path difference, hence explain the colours of thin film.

b) Define : (i) Principal axis (ii) Principal points (iii) Focal points (iv) Nodal points. **4**

c) A biconvex lens has one surface whose radius of curvature is twice the other surface. If a lens is made of glass of refractive index 1.57 and has focal length 20 cm. Determine the two radii?. **3**

Q.6. **a)** Attempt any **ONE.** **8**

1) Describe the construction and working of a He-Ne laser. Draw energy level diagram.
2) What is numerical aperture of an optical fiber ? Derive necessary expression for NA.

b) Explain recording of a hologram. **4**

c) Write a note on Laser cutting. **3**

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