A.T.K.T. F.Y.B.Sc. – Physics 2015-16
Sem – I Cold Course

Note : 1) **All questions are compulsory.**

2) **Figures to the right indicate full marks.**

3) **Use of non-programmable calculators are allowed.**

Q. 1 A) Answer the following:- (any one) 8

1) State and explain Newton's laws of motion.

2) Derive poisseulle's law for a liquid flowing in a narrow tube. State the assumptions made.

B) Answer the following:- (any one) 7

1) For a homogeneous isotropic material show that

$$\sigma = \frac{3k - 2\eta}{6k + 2\eta}$$

2) Define the following :-

i) Limiting friction

ii) Co-efficient of friction

iii) Angle of friction

iv) Angle of repose

C) Answer the following:- (any one) 5

1) Define strain. State its types.

2) A wooden block of mass m kg is placed on an incline plane of an angle θ . The angle θ is adjusted such that the block moves downward with constant speed. Determine the angle θ in terms of co-efficient of friction.

Q. 2 A) Answer the following:- (any one) 8

1) Treating air as a perfect gas, derive an expression for the change of atmospheric temperature with the height above sea level.

2) Prove that, for a real gas,

$$C_p - C_v = \left[\left(\frac{\partial u}{\partial v}\right)_T + P\right]\left(\frac{\partial v}{\partial T}\right)_P$$

Show that it reduces to $C_p = C_v = R$ for a perfect gas.

B) **Answer the following:- (any one)** 7

1) Discuss the concept of internal energy and obtain first law of thermodynamics. Discuss path dependence of heat energy.

2) Obtain relations between p, V and T is an adiabatic interaction for a perfect gas.

C) **Answer the following:- (any one)** 5

1) Calculate the temperature drop over 1km of the atmosphere if r = 1.4 for air and the average molecular weight of air is 0.029 kg/mole R = 8.4 J/mole K and g = 9.8 m/s².

2) Show that $\left(\frac{\partial u}{\partial p}\right)_v = C_v \frac{K_T}{\beta}$ 8

Q. 3 A) **Answer the following:- (any one)**

1) Show that the function $\psi = f_1(x + vt) + f_2(x + vt)$ represents the general solution of the one dimensional wave equation.

2) Write short notes on :-

i) Reverberation

ii) Sabine's formula

iii) Absorption coefficient 7

B) **Answer the following:- (any one)**

1) Describe piezoelectric oscillator and explain how ultrasonic waves are produced by it

2) Which of the following functions are solutions to the one dimensional wave equation

i) $y = P_x + Q_t$ where P and Q are constants

ii) $y = x^2 + v^2t^2$ where v = velocity of wave

iii) $y = 20 \sin kx \cos vt$

iv) $y = e^{kx - vt}$ 5

C) **Answer the following:- (any one)**

1) The auditorium volume is 845m³. The wall area is 200m², the floor area is 180m² and the ceiling area is 180m². The average sound absorption coefficient for the walls is 0.028, for the ceiling is 0.65 and for the floor is 0.06. Calculate the average sound absorption coefficient and the reverberation time.

2) Draw a neat sketch of naturally found quartz crystal, its cross section showing the optical axis, electrical axis and mechanical axis.

Answer the following:- (any three) 15

1) A hall of volume 5500m³ has sound absorbing surface of 750m² and average absorption coefficient 0.504. Calculate the reverberation time.

2) Define the following:-

   i) Viscosity ii) Co-efficient of Viscosity

3) If an isothermal curve and an adiabatic curve are plotted on the same p – v plane, show that the adiabatic is steeper than the isothermal at a common point (p, v)

4) What are the units and dimensions of stress, strain, poisson's ratio and modulus of elasticity?

5) Find the wavelength of audible acaustic waves for the following values for air medium; $\gamma = 1.4$, $R = 8.3 Jmol^{-1} K^{-1}$, $M = 0.029 Kmol^{-1}$ and temperature = 27°C.

6) Certain quantity of a perfect gas at NTP is compressed adiabatically to one fourth of its original volume. Calculate the resulting pressure and temperature (r = 1.4)

—— The End ——