Class / Semester / Subject Code: F.Y.B.Sc. / I / USPH101- Classical Physics-I

Date: 20.11.2019   Time : (3 Hours)   Total Marks: 100

N.B. (1) All questions are compulsory.
      (2) Figures to the right indicate marks for respective sub questions.
      (3) Use of **Non-programmable** calculators is **allowed.**
      (4) Draw **neat labeled diagrams** wherever **necessary.**
      (5) Symbols used have their usual meaning

Q.1) [A] Choose correct alternative in each of the following.   (12)
   (i) 100 kg of body has _____ weight on earth.
        (a) 100 kg   (b) 980 N
        (c) 980 kg   (d) 100 N
   (ii) Lift of an Air plane is based on _____.
        (a) Equation of continuity   (b) Poisseulie's law
        (c) Archimedes principle   (d) Bernoulli's principle
   (iii) In Newton's ring experiment, circular concentric fringes obtained due to light
        phenomenon _____.
        (a) Interference   (b) diffraction
        (c) Dispersion   (d) beats
   (iv) Coma is one type of _____ aberration.
        (a) axial chromatic   (b) monochromatic
        (c) spherical   (d) lateral chromatic
   (v) According to Van der Waal's gas equation, critical coefficient is equal to ___.
        (a) 4.6   (b) 3.375
        (c) 0.375   (d) 2.667
   (vi) In thermodynamic process, internal energy is a _____ function.
        (a) Work   (b) state
        (c) Line   (d) path

[B] Answer in One Sentence   (3)
   (i) What is chemical equilibrium?
   (ii) Define coefficient of friction.
   (iii) What is meant by crossed lens?

[C] Fill in the blanks   (5)
   (i) Heat is energy in _____.
   (ii) The internal energy of a real gas is a function of both temperature and ____.
   (iii) The property of a body to regain its original state or condition when the applied
         forces are removed is called _____.
   (iv) Every thin lens has _____ optical center.
   (v) A thin film will appear either bright or dark when incident light is _____.

Q.2) [A] Attempt any ONE of the following.   (8)
   (i) Derive Poisseulle's law for a liquid flowing in a narrow tube.
   (ii) What do you mean by stress and strain? What are the units of stress and strain?
        Show that the shear strain is equal to the compression and extension strains.

[B] Attempt any ONE of the following.   (8)
   (i) State and prove Bernoulli's theorem.
   (ii) Derive an expression for the moment of a couple required to twist one end of a
        cylinder when other is fixed.

[C] Attempt **any ONE** of the following. (4)
 (i) A body of mass M is suspended by two strings making an angles α and β with the horizontal. Find the tensions in the strings.
 (ii) A bullet moving at 250 m/s penetrates 5 cm into a tree limb before coming to rest. Assuming that the force exerted by the tree limb is uniform, find its magnitude. Mass of the bullet is 10 gram.

Q.3) **[A]** Attempt **any ONE** of the following. (8)
 (i) With the help of neat ray diagram, explain the chromatic aberration of a lens. Derive necessary expression for axial chromatic aberration.
 (ii) Describe Ramsden's eyepiece with the help of a neat ray diagram.

 [B] Attempt **any ONE** of the following. (8)
 (i) Explain the phenomenon of refraction through a thin lens. Derive an expression for the focal length of lens. [Lens maker formula].
 (ii) Derive an expression for the effective path difference for interference by reflected light in thin films.

 [C] Attempt **any ONE** of the following. (4)
 (i) The focal length of a Ramsden's eyepiece is 5 cm. Calculate the focal lengths of each of the lenses used and the distance between them.
 (ii) Fringes of same thickness are observed in a thin glass wedge of R.I. 1.67. If the fringe spacing is 2 mm and wavelength of incident light 5890 A^0, What is the angle of wedge in seconds of an arc?

Q.4) **[A]** Attempt **any ONE** of the following. (8)
 (i) Explain the term 'specific heat' in detail. And show that $C_P - C_V = R$ for a perfect gas.
 (ii) Derive the relations between Van der Waals constants and the critical constants. What is critical coefficient?

 [B] Attempt **any ONE** of the following. (8)
 (i) Obtain relations between p, V and T in an adiabatic interaction for an ideal gas.
 (ii) Describe, with a neat diagram, the experimental arrangement of Andrews experiment. Also explain in short, isothermals based on Andrews observations.

 [C] Attempt **any ONE** of the following. (4)
 (i) Critical volume of helium is 3.75 cm^3/g and a = 1.8 X 10^{-4} Nm^4 mol^{-2}. Calculate P_C and T_C. Given: R= 8.4 $JK^{-1}mol^{-1}$, molecular weight of helium = 4.
 (ii) A gas occupies 1000 cc volume at 4 atm pressure. It expands adiabatically to 1190 cc and the resulting pressure is 3 atm. Calculate 'r'.

Q.5) Attempt **any FOUR** of the following. (20)
 (i) Derive an equation of continuity.
 (ii) Discuss the limitations of Van der Waals equation.
 (iii) State and explain zeroth law of thermodynamics.
 (iv) State Newton's first law of motion and give its physical interpretation.
 (v) Write a short note on 'lens defect: Coma'.
 (vi) What is wedge-shaped film? Explain the formation of interference fringes in wedge-shaped film.