First Year B.Sc., Degree Examinations
September /October 2015
(Directorate of Distance Education.)
PHYSICS
DSA 210 : Paper I : Mechanics, Properties of Matter, Heat and Thermodynamics

Time: 3 hrs.]   *[Max.Marks:75/85*

Instructions :   1. Students who have attended 25 Marks IA Scheme will have to answer for total of 75 Marks.
2. Students who have attended 15 Marks IA Scheme will have to answer for total of 85 Marks.
3. Section E is compulsory for 85 Marks Scheme only.

SECTION - A

I. Answer ALL the questions.   **(10X1=10)**

1. Define centre of mass frame.

2. Define coefficient of restitution.

3. What is a geostationary satellite?

4. State the theorem of perpendicular axes.

5. What is   stream line motion ?

6. Define simple harmonic motion.

7. State Weins displacement law.

8. What is temperature of inversion ?

9. Define Poisson's Ratio.

10. Define Universal gravitational constant G.

SECTION - B

II. Answer any FIVE questions.   **(5X3=15)**

11. If $\vec{A} = 5\,\hat{\imath} + 6\,\hat{\jmath} - 4\,\hat{k}$ and $\vec{B} = 2\,\hat{\imath} + 3\,\hat{\jmath}$, calculate the angle between them.

12. What are the uses of artificial satellite ?

13. Define the term angle of contact. Mention the factors on which it depends.

14. Derive an expression for work done in an adiabatic change.

15. Explain distribution of energy in the black body radiation spectrum.

16. State Galilean principle of relativity. Write the Galilean transformation equations.

17. Derive Stoke's law by the method of dimensions.

SECTION - C

III. Answer any FIVE questions. (5X6=30)

18. What are inertial and non-inertial frames of reference ? Show that accelerated frame is a non inertial frame.

19. Derive the expression for twisting couple per unit twist of a cylinder.

20. State Kepler's laws of planatory motion. Prove the law of period of planets round the sun.

21. Deduce the expression for coefficient of viscosity by capillary flow method.

22. State Maxwell's law of velocity distribution and law of equipartition of energy. Obtain an expression for mean free path of the gas molecule.

23. Derive Planck's law of radiation. Discuss it's significance.

24. Derive Clausius Clayperon equation.

SECTION - D

IV. Answer any TWO questions. (2X10=20)

25. a) Obtain the expression for the final velocities of two particals undergoing elastic collision.

    b) Earth revolves round the sun in an orbit of radius 1.5×10^{11} m with a time period of 1 year. Calculate mass of sun. Given $G = 6.67 \times 10^{-11}$ Nm^2/kg^2.

    (7+3)

26. a) Obtain an expression for the depression of the loaded end of a single cantilever.

    b) Find the energy stored in a wire 5 m long and 1mm in diameter, when it is stretched through 3×10^{-3} m by a load. Given Yong's modulons of wire is 2×10^{11} N/m^2.   (6-4)

27. a) What is an irreversible process. Obtain expression for efficiency of Carnot's. Heat engine interms of temp of source and sink.

    b) One mole of perfect mono atomic gas at 27^0C is compressed so that it's pressure is doubled. Calculate the resulting difference in temperature.   (7+3)

28. a) Distinguish between ideal and real gases. Explain the principle of Regenerative cooling with a neat diagram.

    b) Calculate the change in entropy when 0.08 kg of water at 20^0C is mixed with 0.12 kg of water at 50^0C given specific heat of water $= 4200$ J/kg.   (7+3)

SECTION - E

V. **Answer any ONE of the following questions.** (1X10=10)
   (Compulsory question for 85 marks scheme only)

   29. a) Find the Radial and transverse components of velocity and acceleration of a particle moving in a plane.

   b) A particle of mass 'm' moves on the path given by $\vec{r} = \hat{\imath}\, a . \cos wt + \hat{\jmath} . b \sin wt$. Calculate the torque about the origin. **(6+4)**

   30. a) Find the expression for instantaneous velocity and maximum velocity of a rocket by neglecting the effect of gravity.

   b) The particle moves from $3\hat{\imath} - 4\hat{\jmath} - 2\widehat{k}$ to the point $3\hat{\jmath}\, \text{-}2\hat{\imath}\, \text{-}5\widehat{k}$ under the influence of a force $-2\hat{\imath} + 3\hat{\jmath} + 4\widehat{k}$ Newton. Calculate the work done. **(7+3)**

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