

Q.P. Code – 50621

First Year B.Sc. Degree Examination

SEPTEMBER/OCTOBER 2013

(Directorate of Distance Education)

Physics

**(DSA 210) Paper I – MECHANICS, PROPERTIES OF MATTER,
HEAT AND THERMODYNAMICS**

Time : 3 Hours

[Max. Marks : 75/85

Instructions to Candidates :

- 1) *Students who have attended 25 marks I-A scheme will have to answer for total of 75 marks.*
- 2) *Students who have attended 15 marks I-A 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** questions :

(10 × 1 = 10)

1. Express velocity in terms of the position vector.
2. State Galilean principle of relativity.
3. Define critical temperature.
4. What is the advantage of multistage rockets?
5. Define Solar constant.
6. Define scalar triple product of three vectors.
7. Define the universal gravitational constant 'G'.
8. Define simple harmonic motion.
9. What is a compound pendulum?
10. State Carnot's theorem.

Q.P. Code – 50621

SECTION – B

II. Answer any **FIVE** questions : **(5 × 3 = 15)**

11. Explain the terms moment of inertia and radius of gyration. What is the unit of M-I?
12. Define Poisson's ratio. What are its limiting values? Define Stress.
13. What are cohesive and adhesive forces? Give examples.
14. Derive Stoke's law by the method of dimensions.
15. Obtain the relation between surface energy and surface tension.
16. Distinguish between isothermal and adiabatic process.
17. Explain distribution of energy in the black body radiation spectrum.

SECTION – C

III. Answer any **FIVE** questions : **(5 × 6 = 30)**

18. Derive expression for twisting couple per unit twist of a cylinder or wire.
19. Derive expression for efficiency of Carnot's heat engine in terms of temperature of source and sink.
20. Describe porous plug experiment and discuss the results.
21. Derive an expression for Moment of inertia of solid cylinder about an axis through its centre and perpendicular to its length.
22. Define centre of mass of a system of particles. Show that the velocity of the centre of mass of a closed system remains constant.
23. Derive Kepler's laws of planetary motion from Newton's law of gravitation.
24. Derive Planck's law of radiation. Discuss its significance.

Q.P. Code – 50621

SECTION – D

- IV. Answer any **TWO** questions : **(2 × 10 = 20)**
25. (a) Obtain the expressions for the final velocities of two particles undergoing elastic collision.
- (b) Earth revolves round the sun in an orbit of radius 1.5×10^{11} m with a time period of 365 days. Calculate the mass of the sun.
 $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ Kg}^{-2}$. **(7 + 3)**
26. (a) Derive Clausius Clapeyron Latent heat equation and discuss the effect of pressure on melting point and boiling point.
- (b) Calculate the change in entropy when 0.08 kg of water at 20°C is mixed with 0.12 kg of water at 50°C . Specific heat of water = 1000 cal/kg. **(7 + 3)**
27. (a) Obtain expression for instantaneous velocity of a rocket during its flight neglecting the effect of gravity. Hence deduce the expression for final velocity of the rocket.
- (b) The force of attraction between spheres of mass 40 kg and 80 kg is equal to the weight 8.7×10^{-8} Kg. If the distance between the centres of the two spheres is 0.5 m, calculate the value of G . **(7 + 3)**
28. (a) Derive an expression for the depression at the loaded end of a single cantilever.
- (b) A cantilever of length 0.5 m depressed by 1.5×10^{-2} m at the loaded end. Calculate the depression at a distance of 0.30 m from the fixed end. **(7 + 3)**

Q.P. Code – 50621

SECTION – E

V. Answer any **ONE** of the following questions : **(1 × 10 = 10)**

(Compulsory question for 85 marks scheme only)

29. (a) Obtain the expression for P.E. and K.E. for a particle executing SHM. Hence show that the total energy of the system is conserved.
- (b) Obtain an expression for areal velocity in plane polar co-ordinates. **(7 + 3)**
30. (a) Discuss the motion of a conical pendulum w.r.t. (i) laboratory frame and (ii) a frame attach to the rotating bob.
- (b) State and prove parallel axes theorem. **(6 + 4)**
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