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M-7

Sl.No.

3000

Total No. of Pages : 2

I Semester B.Sc. Examination, October/November - 2018

(Scheme : Semester - CBCS)

PHYSICS

Mechanics, Properties of Matter and Electrostatics (Paper-I)

Time : 3 Hours

Max. Marks : 80

Instruction :- Answer any two from Part - A and any two from Part - B. Answer any three from Part - C. Answer any ten from Part - D.

PART - A

1. a) Show that an accelerated frame of reference is non - inertial. [6]
b) Obtain an expression for radial and transverse components of velocity of a particle moving in a plane. [6]
2. a) Obtain an expression for the moment of Inertia of a solid cylinder about an axis passing through its centre and perpendicular to its length. [7]
b) Obtain an expression for instantaneous velocity of a rocket in flight without gravitational field. [5]
3. a) From Newton's law of gravitation, obtain Kepler's first & third law of planetary motion. [7]
b) Derive an expression for escape velocity in the gravitational field of Earth. [5]

PART - B

4. a) With diagram explain the theory of rotation viscometer. [7]
b) Obtain an expression for surface tension of a liquid by drop weight method. [5]
5. a) Give the theory of light single cantilever. [6]
b) Derive an expression for couple per unit twist of a wire fixed at one end and twisted at the other end. [6]
6. a) Obtain an expression for mechanical force & electric pressure on a charged surface. [5]
b) Give the constitution and theory of Helmholtz double coil galvanometer. [7]

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PART - C

7. A circular disc of mass 0.1kg and radius 0.1 m is making 120 rpm about an axis passing through its centre and perpendicular to its plane. Calculate its kinetic energy. [4]
8. A body of mass 5kg at rest explodes into three pieces. Two pieces, each of mass 1kg fly off perpendicular to each other with a speed of 100m/s. Calculate the velocity of the third piece. Also calculate the ratio of the kinetic energy of third piece and one of the small pieces. [4]
9. Calculate the excess pressure inside a soap bubble of radius 3×10^{-3} m. Surface tension of soap solution is 20×10^{-3} N/m. [4]
10. A uniform metal disc of diameter 0.1m and mass 1.2 kg is fixed symmetrically to the lower end of a torsion wire of length 1m and diameter 1.44×10^{-3} m. The upper end of the wire is fixed. The time period of torsional oscillations is 1.98s. Calculate the modulus of rigidity of the material of the wire. [4]

PART - D

11. a) What is fictitious force? Explain. [2]
- b) Define moment of inertia and radius of gyration of a body. [2]
- c) Define elastic and inelastic collision. [2]
- d) Explain the concept of multistage rocket. [2]
- e) State the law of conservation of angular momentum. [2]
- f) Mention the conditions for geo - stationary satellite. [2]
- g) Discuss the variation of viscosity of a liquid with temperature and pressure. [2]
- h) State and explain Hooke's Law. [2]
- i) What are I - section giveters? Explain. [2]
- j) What is the principle of attracted disc electrometer. [2]
- k) Why damping correction is necessary in moving coil galvanometer. [2]
- l) What is charge and current sensitivity of moving coil galvanometer. [2]



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M-402

Total No. of Pages : 4

I Semester B.Sc. Examination, Oct./Nov. - 2018

(Scheme : CBCS/Semester)

MATHEMATICS (Paper - I)

Algebra I and Calculus I

Time : 3 Hours

Max. Marks : 80

- Instructions : i) Answer all the five questions.
ii) First question carries 20 marks and remaining questions carry 15 marks.

1. Answer any TEN questions. Each question carries Two marks.

- a) Find the inverse of the matrix $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ by elementary row operations.
- b) Find the value of λ for which the following system has a non trivial solution.
- $$2x - y + 2z = 0$$
- $$3x + y - z = 0$$
- $$\lambda x + 2y + z = 0$$
- c) If λ is an eigen value of the matrix A, then show that λ^2 is an eigen value of A^2 .
- d) Transform the equation whose roots are the reciprocals of that of the equation. $3x^4 - 3x^2 + 4x - 1 = 0$.
- e) If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$. Find $\sum \alpha^2$.
- f) Show that the equation $x^6 + 4x^2 - 2x + 1 = 0$ has atleast four imaginary roots
- g) Find the n^{th} derivative of $y = \log(2x+1)$



h) Show that $f(x) = x^5 - 5x^4 + 5x^3 - 1$ has a maximum at $x = 1$

i) Evaluate $\int_0^1 \frac{x^4}{\sqrt{1-x^2}} dx$

j) Find ϕ , for the curve $r = a(1 + \sin \theta)$ at $\theta = \frac{\pi}{6}$

k) Find $\frac{ds}{dt}$ for the curve $x = a(t + \sin t)$, $y = a(1 - \cos t)$

l) Find the pedal equation of the curve $r = a\theta$.

2. Answer any **THREE** questions. Each question carries **Five** marks.

a) Find the rank of the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$

b) Show that matrix $A = \begin{bmatrix} 1 & 2 & -2 & 3 \\ 2 & 5 & -4 & 7 \\ -1 & -3 & 2 & -1 \\ 2 & 4 & -1 & 3 \end{bmatrix}$

is row equivalent to the matrix $B = \begin{bmatrix} 1 & 2 & -2 & 3 \\ 0 & 1 & 8 & 1 \\ 0 & 0 & 1 & \frac{3}{8} \\ 0 & 0 & 0 & 1 \end{bmatrix}$

- c) Test for consistency and solve the system of equations

$$x - 7y + 15z = -14$$

$$2x + 3y - 4z = 6$$

$$3x - 4y + 11z = -8$$

$$5x - y + 7z = -2$$

- d) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 1 & 2 \\ 5 & 4 \end{bmatrix}$

- e) Using Cayley-Hamilton theorem, Find the inverse of the matrix

$$\begin{bmatrix} 1 & -2 & 1 \\ 2 & 1 & 0 \\ 3 & 2 & 5 \end{bmatrix}$$

3. Answer any THREE questions. Each question carries Five marks.

- a) Solve : $3x^6 + x^5 - 27x^4 + 27x^2 - x - 3 = 0$
- b) Solve : $4x^3 + 20x^2 - 23x + 6 = 0$, given that it has a multiple root.
- c) Solve : $x^3 - 18x - 35 = 0$ by Cardon's method.
- d) Solve the equation $x^4 - 2x^2 + 8x - 3 = 0$ by Descarte's method.
- e) Solve : $x^4 - 2x^3 + 4x^2 + 6x - 21 = 0$, given that the sum of two of its roots is zero.

4. Answer any **THREE** questions. Each question carries Five marks.

a) If $y = a \cos(\log x) + b \sin(\log x)$ then show that

$$x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$$

b) Find the intervals of convexity, Concavity and points of inflexion for the curve $y = \sin x$ in $(0, 2\pi)$

c) Obtain reduction formula for $\int \sin^n x dx$ and hence evaluate $\int_0^{\pi/2} \sin^n x dx$.

d) Evaluate $\int_0^{\pi} \frac{\sin^4 \theta}{(1 + \cos \theta)^2} d\theta$

e) Prove that $\int_0^{\pi/2} \log(\sin x) dx = \frac{\pi}{2} \log\left(\frac{1}{2}\right)$

5. Answer any **THREE** questions. Each question carries Five marks.

a) Show that the curves $r = a \sec^2 \frac{\theta}{2}$ and $r = b \operatorname{cosec}^2 \frac{\theta}{2}$ intersect orthogonally.

b) With usual notation, prove that $\rho = \frac{(r^2 + r_1^2)^{3/2}}{r^2 + 2r_1^2 - r r_2}$

c) Find the pedal equation of the parabola $y^2 = 4a(x+a)$

d) Find the radius of curvature for the curve $x^4 + y^4 = 2$ at the point $(1, 1)$

e) Show that the evolute of the parabola $y^2 = 4ax$ is $27ay^2 = 4(x-2a)^3$



