Model Question Paper

B.Sc (Hons) Semester – V

Subject – Mathematics

Paper – CC MATH 512

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Group – A

Each parts of questions carries 2 Marks

1. Choose the correct answers: (10×2=20)

(a) Bernoulli's equation cannot be applied when the flow is

(i) Rotational (ii) Turbulent (iii) Unsteady

(iv) All of above.

(b) Streamline and equipotential lines in a flow field

(i) are parallel to each other.

(ii) are identical to each other.

(iii) are perpendicular to each other.

(iv) intersect at acute angles.

(c) The method in which we study about the history each fluid particle mathematically in fluid dynamic is

(i) Bernoulli's method (ii) Eulerian Method

(iii) Lagrangian metod (iv) None of these.

(d) Equation of continuity by Euler's Method is

(i) $\frac{\partial \rho}{\partial t} + \rho . \nabla . q = 0$ (ii) $\frac{\partial \rho}{\partial t} - \rho \nabla . q = 0$

(iii) $\frac{\partial \rho}{dt} + \nabla . (\rho q) = 0$ (iv) None of these

(e) The curl of any particle of a rigid body is equal to

(i) Twice the angular Velocity (ii) Angular Velocity

(iii) half the angular velocity (iv) Thrice the angular Vel.

(f) Singular points are
(i) Regular (ii) Irregular (iii) Regular or irregular
(iv) None of these

(g) For nth Legendre polynomial
$C_n x \left| \frac{d^n (x^2-1)^n}{dx^n} \right|$; the value of C_n is

(i) $\frac{1}{\lfloor n \cdot 2^n}$ (ii) $\frac{\lfloor n}{2^n}$ (iii) $\frac{\lfloor n}{2}$ (iv) $\frac{2^n}{\lfloor n}$

(h) $x \left| J_{n-1}(x) + J_{n+1}(x) \right|$ is equal to

(i) $2 J_n(x)$ (ii) $2 J'_n(x)$ (iii) $2n J_n(x)$ (iv) None

(i) The hypergeometric function $F(\alpha; \alpha; x) =$
(i) $\sin x$ (ii) 1 (iii) e^x (iv) $\cos -1 x$.

(j) $\lim_{z \to 0} \frac{J_n(z)}{z^n} =$ ---- when $n > -1$

(i) $\frac{1}{2\lceil(n+1)}$ (ii) $\frac{1}{2^n \lceil(n+1)}$ (iii) $\frac{2}{\lceil(n+1)}$ (iv) $\frac{\lceil n+1}{2}$

Group – B

Answer any four questions $(5 \times 4 = 20)$
Each questions carries 5 marks

2.) Define surfaces of equi-pressure and resultant thrust.

3.) Derive equation of continuity in cartesian co-ordinates.

4. write down the Bernoullis equation in hydrodynamics.

5. Explain Langrangian method of fluid description

6. Solve in series the equation

$$\frac{d^2y}{dx^2} + xy = 0$$

7. Derive the recurrence relation

$$nP_n = xP'_n - P'_{n-1}$$

8. $[J_{1/2}(x)]^2 + [J_{-1/2}(x)]^2 = 2/\pi x$

9. (a) $\sin^{-1} x = x F(1/2; 1/2; 3/2; x^2)$.

(b) $\tan^{-1} x = x F(1/2; 1; 3/2; -x^2)$.

Group – C

Answer any two questions (15×2=30)

Each carries 15 marks

10. A hollow cone whose axis is vertical and base downwards, is filled with equal volumes of two liquids whose densities are in the ratio 3:1; show that thrust on the base is $(3 - 3\sqrt{4})$ as much as it is when the vessel is filled with the lighter liquid.

11. (a) Show that the free surface of heavy homogeneous liquid at rest under gravity is horizontal

(b) liquids of density ρ and σ occupy area subsstending angle α and β at the centre of a fine vertical circular tube. If the surface of separation be at lowest point, Prove that

$$\sin\frac{\beta}{2} = \sqrt{\frac{\rho}{\sigma}}\sin\frac{\alpha}{2}.$$

12. (a) Derive Rodrigues formula.

(b) $\int_{-1}^{1} P_m(x) P_n(x)\, dx = 0$ if $m \neq n$.

13. write Bessel's equation and its solution. (4)

X

Answers of objective.

a – (iv)
b – (iii)
c – (iii)
d – (iii)
e – (i)
f – (iii)
g – (i)
h – (iii)
i – (iii)
j – (i)