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S. NO.: 1~0 BATCH: 2014 – 2016 Reg. No.:

END OF SEMESTER EXAMINATIONS, APRIL / MAY - 2018

FLUID DYNAMICS

SUBJECT CODE : 14P3MA12

MAJOR : M.Sc (Mathematics) SEMESTER : III

TIME : 3 HOURS MAX. MARKS: 70

SECTION A – (5 X 4 = 20)

Answer All the Questions:

1. Discuss the Fluid property presure.

[OR]

2. The velocity in the flow field is given by $\vec{q} = (Az - By)\vec{i} + (Bx - Cz)\vec{j} + (Cy - Ax)\vec{k}$ where A,B,C are nonzero constants. Determine the equations of vertex lines.
3. Discuss the Relation between Stress and Rate of strain.

[OR]

4. Obtain the equation of continuity.
5. Explain Eulesian equations of motion.

[OR]

6. Give examples of irrotational and rotational flows.
7. Water at 20° flows between two large parallel plates at a distance of 1.5 mm apart. If the average velocity is $0.15 m/s$. Find
   a) the maximum velocity
   b) the pressure drop
   c) the wall shearing stress.

[OR]

8. Explain the Flow between Two coaxial cylinders.
9. Obtain the other form of the Von Karman Integral Relation.

[OR]

10. Based on the Von Karman integral relation, determine the local frictional co-efficient c_i foi flow over a flat plate.

SECTION B – (5 X 10 = 50)

Answer All the Questions:

11. Obtain viscosity (μ) of the fluid.

[OR]

12. Define i) Translation
    ii) Rotation
    iii) Rate of Deformation
    iv) Rate of Angular deformation.
13. Obtain the Nature of stresses.

[OR]

14. Obtain Navier-Stokes Equation.
15. State and prove the moment of momentum theorem.

[OR]

16. Verify that the stream function ψ and velocity potential ϕ of a three-dimensional (axially symmetric) doublet flow satisfy the Laplace equation.
17. Obtain the flow between Two Concentric Rotating Cylinders.

[OR]

18. a) Determine the maximum value of the velocity profile in the annular space between two coaxial cylinders.
    b) If $r_1 = 50mm$, $r_2 = 75mm$ and the volumetric flow of water $Q = 0.006 m^3 s$. Calculate
    i) the pressure drop
    ii) the maximum value of r_2 and
    iii) the shearing stress at the wall of both cylinders.
19. Obtain the Boundary Layer equation in Two-dimensional flow.

[OR]

20. Obtain the Von Karman integral relation by momentum law.

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S.NO. 84 BATCH: 2014 – 2016 Reg. No.

END OF SEMESTER EXAMINATIONS, APRIL / MAY-2018
DIFFERENTIAL GEOMETRY
SUBJECT CODE: 14P3MA15

MAJOR: M.Sc. Mathematics 14 **SEMESTER : IV**
TIME : 3 HOURS **MAX. MARKS: 70**

SECTION – A (5 X 4 = 20)

Answer ALL the Questions:

1. Find the unit tangent vector and equation of the tangent line at any point on the circle $x = a\cos u$, $y = a\sin u$, z=0.

(OR)

2. Show that the tangent to the space curve and to the locus of its centres of its curvature and corresponding points are normal.
3. Show that the projection C_1 of a general helix C on a plane perpendicular to its principal normal of the helix and its corresponding curvature is given by $k = k_1 \sin^2 \alpha$.

(OR)

4. Show that the necessary and sufficient condition that the curve be a helix is that $\left[\overline{t'}, \overline{t''}, \overline{t'''}\right] = 0$.
5. Derive: First Fundamental Form.

(OR)

6. Define: Polar Developable and Tangential Developable.
7. Explain Euler's Theorem.

(OR)

8. Distinguish between Curves and Developable.
9. State and prove Hilbert theorem.

(OR)

10. When the lines of curvature one taken as coordinates line. Show that the Codazzi equations takes the form $\frac{\partial K_1}{\partial v} = \frac{1}{2}E_v(K_2 - K_1)$; $\frac{\partial K_2}{\partial u} = \frac{1}{2}\frac{G_u}{G}(K_1 - K_2)$.

SECTION – B (5 X 10 = 50)

Answer ALL the Questions:

11. State and Prove: Serret-Frenet Formula.

(OR)

12. Find the curvature and the Torsion for Circular helixr= $(a\cos u, a\sin u, bu)$.
13. Show that the centre of the osculating plane lies on the polar axis.

(OR)

14. Derive the general solution of the natural equation.
15. Show that the orthogonal family of trajectory (Mdu+Ndv)=0 given (EN-FM) du+ (FN-GM) dv=0.

(OR)

16. Find the tangential envelope of the planes $u^3 - 3u^2x_1 + 3ux_2 - x_3 = 0$.
17. Show that the intersection of the surface with a plane close to the tangent plane parallel to is it in a first approximation similar to Dupin indicatrix.

(OR)

18. State and Prove Meusnier's theorem.
19. Show that the Gaussian Curvature $K = \dfrac{eg - f^2}{EG - F^2}$ can be expressed as

$$K = \frac{1}{EG - F^2}\left\{\begin{pmatrix} \frac{1}{2}E_{vv} + F_{uv} - \frac{1}{2}G_{uu} & \frac{1}{2}E_u & F_u - \frac{1}{2}E_v \\ F_v - \frac{1}{2}G_u & E & F \\ \frac{1}{2}G_v & F & G \end{pmatrix} - \begin{pmatrix} 0 & \frac{1}{2}E_v & \frac{1}{2}G_u \\ \frac{1}{2}E_v & E & F \\ \frac{1}{2}G_u & F & G \end{pmatrix}\right\}$$

(OR)

20. Obtain the equation of Geodesics using Christofell symbols.

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