Program : M.A./M.Sc. (Mathematics)
M.A./M.Sc. (Final) Question Bank-2015
Paper Code:MT-07
Section – A

1. Name the types of forces under which the fluid tetrahedron will be in equilibrium? [Pg N. 452, Art 9.1(Fluid dynamics, Shanti swarup)
2. Give the eq. of continuity in vector form.
   [Pg no. 21 art 23.2 (MA/MSc. MT-07)
3. Name four fundamental units in fluid dynamics in which the dimensions of all the physical quantities can be expressed?
   [Pg no. 35 art 3.4 (MA/MSc. MT-07)
4. What do you mean by incompressible fluid motion?
   [Pg no. 43 art 4.2 (MA/MSc. MT-07)
5. Define Himenz Flow.
   [Pg no. 64 art 5.3 (MA/MSc. MT-07)
6. Define unsteady motion?
   [Pg no. 71 art 6.2 (MA/MSc. MT-07)
7. Give the expression for the Velowty distribution for the flow in plane coquette flow with porous boundaries?
   [Pg no. 79 art 7.42 (MA/MSc. MT-07)
8. What do you mean by adiabatic exponent of gases?
   (Ref: Page 14, Art 1.17, MA/M.Sc. MT-07)
9. Define density with respect to fluid dynamics.
   [Pg no. 2 art 1.3 (MA/MSc. MT-07)
10. Define circulation with respect to fluid dynamics.
    [Pg no. 27 art 2.8 (MA/MSc. MT-07)
11. State the Reynold's law?
    [Pg no. 34 art 3.2 (MA/MSc. MT-07)
12. What do you mean by Startup flow?
    [Pg no. 71 art 6.2 (MA/MSc. MT-07)

13. What do you mean by ‘Suction’?

    [Pg no. 76 Art 7.21 (MA/MSc. MT-07)

14. Write the stoke’s eq. for slow motion?

    [Pg no. 96 Art 9.2 (MA/MSc. MT-07)

15. Define the momentum thickness?

    [Pg no. 109 Art 10.4 (iii) (MA/MSc. MT-07)

16. Give the equation from which we can calculate the temperature distribution for different situations between parallel plates.

    (Ref: Page 81, Art 8.2, MA/M.Sc. MT-07)

Section – B

1. Prove that the two principal directions corresponding to any 2 distinct principal stresses are orthogonal?

   [Pg no. 462 art 9.7 (Fluid dynamics, Shanti swarup)

2. Prove that the vector Ω of an incompressible viscous fluid moving under no external fore satisfies the differential eq.

   $$\frac{d\vec{\Omega}}{dt}=\left(\vec{\Omega}.\nabla\right)\vec{q}+\mu\nabla^2\vec{\Omega}$$

   Where μ is the coefficient of viscosity?

   [Pg no. 503 Ex. 18 (Fluid dynamics, Shanti swarup)

3. The loss of pressure $\nabla\rho$ for laminar flow in a pipe is a funetion of pipe length l, its diameter D, mean velocity, U and the dynamic viscosity μ. Determine an expression for the pressure lost?

   [Pg no. 517 Ex. 14 (Fluid dynamics, Shanti swarup)

4. Prove that in slow steady motion of a viscous liquid in two dimensions.

   $$\nu\nabla^2\psi=\frac{\partial x}{\partial x}-\frac{\partial y}{\partial y}$$

   Where (X,Y) is the impressed force per unit area.

   (Pg no. 579 Ex. 11 (Fluid dynamics, Shanti swarup)

5. A viscous liquid flows steadily parallel to the axis in the annular space between 2 co-axial cylinder of radii a na (n>1). Determine the rate of discharge?

   [Pg no. 579 Ex. 19 (Fluid dynamics, Shanti swarup)

6. Air flow over a Hati plat 60 cm long and 1 m. wide at wide at a velocity 8 m/s. Find the boundary layer thickness at the end of plate, share stress at 30 m from the leading edge and the total drag force on both sides of plates. Assuming p = 1.20 kg/m^3 and V = $1.44X10^{-1}$ stokes.

   [Pg no. 646 Ex. 4 (Fluid dynamics, Shanti swarup)

7. Explain –

   (i) Boundary layer Thickness (ii) Displacement Thickness

   [Pg no. 108 art 10.4 (MA/MSc. MT-07)

8. Discuss the thermal boundary layer simple solution for Pr = 1?

   [Pg no. 119 art 12.3 (MA/MSc. MT-07)

9. What is vorticity. Prove that vorticity diffuses through a liquid in almost the same way as heat dais.

   [Pg no. 26 Art 2.7 (MA/MSc. MT-07)

10. Explain – (i) Mach number, (ii) Brinkman Number

    [Pg no. 38 Art 3.8.3, Pg. N. 39 (Art 3.8.3) (MA/MSc. MT-07)

11. The velocity components are given by

    $$\mu(y) = y\frac{U}{h} + \frac{h^2}{2\mu}\left(-\frac{dp}{dx}\right)\frac{y}{h}\left(1-\frac{y}{h}\right), v = 0 = \omega$$

    Prove that the velocity components satisfy the eq. if motion. The body force s neglected, h, U, dp/dx are constants, and p = p (α)?

    [Pg no. 500 Ex. 15 (Fluid dynamics, Shanti swarup)

12. The losser $\Delta h / l$ per unit length of pipe in a fluid flo through a smooth pipe depend upon velocity V, diameter D, gravity g, dynamic viscosity μ, and density P. with dimensional analysis determine the general form of eq.?

    [Pg no. 522 Ex. 5 (Fluid dynamics, Shanti swarup)

13. Oil is filled between 2 concentric rotating cylinders with radii 5 in and $5\frac{1}{2}$ in. Assuming μ = 0.005 lbf – sef/ft^3. The inner cylinder rotates at a speed of 5 rpm, while the outer cylinder is at rest. Calculate the stress at the wall of the inner cylinder?

    [Pg no. 566 Ex. 9 (Fluid dynamics, Shanti swarup)

14. Viscous in compressible fluid is in steady two dimensional radial motion-between 2 non-parallel plane walls, r and Q are polar coordinates. R being the distance from the line of intersection of the planes of the walls, which are $\theta = \pm\alpha$, prove that the velocity is given by $\mu = f(0)/r$, where

    $$(df/d\theta)^2 = (2/3v)(h - 3vkf - 6vf^2 - j^3)$$

    h & k. being constants.

    [Pg no. 589 Ex. 20 (Fluid dynamics, Shanti swarup)

15. Determine the displacement thickness arid momentum thickness for the laminar boundary on a flat plate for which the velocity distribution is given by the relation?

    $$\mu/U = 2(y/\delta) - 2(y/\delta)^3 + (y/\delta)^4$$

    [Pg no. 645 Ex. 3 (Fluid dynamics, Shanti swarup)

16. A liquid occupying the space between two co-axial circular cylinders is acted upon by a force e/r per unit moss, where r is the distance from the axis, the lines of force being airless sound the axis. Prove that in the steady mention the velocity at any point is given by $\frac{c}{2v}\left[\frac{b^2}{r}\frac{r^2-a^2}{b^2-a^2}\log\left(\frac{r}{a}\right)\right]$, where v is the coefficient of kinematic viscosity.

    [Pg no. 580 Ex. 13 (Fluid dynamics, Shanti swarup)

Section – C

1. A fluid flow situation depends upon the velocity V. the density p, several linear dimensions $l; l_1; l_2$;d, pressure drop Δp, gravity g, viscosity μ, surface tension σ, and

bulk modules of elasticity k. Apply dimensional analysis to these variables to find a set of Π parameters.

[Pg no. 524 Ex. 8 (Fluid dynamics, Shanti swarup)

2. Discuss the unsteady motion of a flate plate?

   [Pg no. 570 Ans. 11.7 (Fluid dynamics, Shanti swarup)

3. Discuss the flow due to an oscillating flat plate?

   [Pg no. 572 Ans. 11.8 (Fluid dynamics, Shanti swarup)

4. Two-dimensional potential flow of an in viscid and incompressible fluid near the stagnation point at the origin at a fixed point taken as y=0 is given by u-bx. Show that the corresponding problem for a viscous liquid has a solution.

   $\mu = bx\frac{\partial\phi}{\partial n}, v = \sqrt{bv}\phi(n), n = y\sqrt{bv},$

   Where $d^3\phi/dn^3 + d^2\phi/dn^2 - (d\phi/dn)^2 + 1 = 0$ with bounding conditions.

   Whee n = 0, $\phi = 0$ and $n = \omega$, $d\phi/dn = 1$

   [Pg no. 590 Ans. 11.7 (Fluid dynamics, Shanti swarup)

5. Prove that there are only 5 independent dimension less groups in the viscous compressible fluid motion?

   [Pg no. 518 Ex. 1 (Fluid dynamics, Shanti swarup)

6. Discuss the steady motion of a viscous fluid due to a slowly rotating sphere?

   [Pg no. 56 Art. 11.5 (Fluid dynamics, Shanti swarup)

7. Discuss the unsteady flow of viscous in compressible between 2 parallel plate?

   [Pg no. 575 Art 11.10 (Fluid dynamics, Shanti swarup)

8. Obtain the solution of the Navies Stokes eq. at low. Reynolds no.?

   [Pg no. 594 Art 11.13 (Fluid dynamics, Shanti swarup)