Program : M.A./M.Sc. (Mathematics)

M.A./M.Sc. (Final)

Paper Code:MT-07

Viscous Fluid Dynamics

Section – B

(Short Answers Questions)

1. What is fluid? Describe briefly the fluid.

A MT-07, Pg. No. 2

2. Write a short note on :
   (a) Density
   (b) Viscosity

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3. Define viscosity obtain Newton's law of viscosity.

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4. Derive $\bar{q} = \bar{q} + \overline{w} \times d\bar{r} + \bar{D}$

A MT-07, Pg. No. 3

5. Discuss strain analysis.

A MT-07, Pg. No. 5

6. Distinguish between body and surface forces.

A MT-07, Pg. No. 5

7. What is stress and stress vector?

A MT-07, Pg. No. 5

8. Discuss the stress in a fluid at rest

A MT-07, Pg. No. 11

9. Define stress in a fluid in motion.

A MT-07, Pg. No. 12

10. What assumptions did the stokes make order to find relation between stress and rate of strain components.

A MT-07, Pg. No. 12

11. Define stoke's law of friction.

A MT-07, Pg. No. 13

12. State Thermal conductivity.

A MT-07, Pg. No. 14

13. Write a short note on specific Heat.

A MT-07, Pg. No. 14

14. State generalized law of Heat conduction.

A MT-07, Pg. No. 14

15. The stress tensor at a point P is:

$$\sigma ij = \begin{vmatrix} 7 & 0 & -2 \\ 0 & 5 & 0 \\ 2 & 0 & 4 \end{vmatrix}$$

Determine the stress vector on the plane at P whose unit normal is

$$\hat{n} = \frac{2\hat{\imath}}{3} - \frac{2}{3}\hat{\jmath} + \frac{1\hat{k}}{3}$$

A MT-07, Pg. No. 15

16. Write about fundamental equations of flow of viscous compressible fluid.

A MT-07, Pg. No. 19

17. Define equation of state and give an idea about How does it vary with fluid.

A MT-07, Pg. No. 19

18. State law of conservation, define equation of continuity and write the eq^n of continuity in Cartesian tensor notation.

A MT-07, Pg. No. 20

19. State conservation of energy and express it into equation form.

A MT-07, Pg. No. 23

20. Write a short note on:
    (a) boundary conditions
    (b) Varticity transport equations
    (c) Circulation

21. Write down fundamental equations of viscous incompressible fluid in certain tensors.

A MT-07, Pg. No. 29

22. State Reynold's law.

A MT-07, Pg. No. 34

23. Discuss the dimensional analysis.

A MT-07, Pg. No. 35

24. Write the method of finding out the TT-products.

A MT-07, Pg. No. 36

25. What is the physical importance of non-dimension parameters. Discuss the Froude number.

A MT-07, Pg. No. 37-38

26. What is Reynold's number. Demonstrate the importance of Reynold's number.

A MT-07, Pg. No. 37

27. Which dimensionless parameters is the ratio of kinematic viscosity to the thermal diffusivity? Write a short note on it.

A MT-07, Pg. No. 38

28. Write about :
    (a) Pe'clet Number
    (b) Grashoff Number

A MT-07, Pg. No. 39

29. Define Nusselt number and Newton's cooling law.

A MT-07, Pg. No. 40

30. An oil specific gravity 0.85 if flowing through a pipe of 5 cm diameter at the rate of 3 liter/sec. Find the type of flow if the viscosity for the oil is 3.8 paise.

A MT-07, Pg. No. 41

31. A 1.20 model of an air duct is to be tested in water which is 45 times more viscous and 850 times more dense than air. What should be the pressure drop in the prototype if the pressure drop is 3kg/cm^2 in the model when tested under hydrodynamically similar conditions?

A MT-07, Pg. No. 41

32. Define Plane-couttee flow.

A MT-07, Pg. No. 45

33. Write about steady laminar flow of viscous incompressible fluid between two infinite stationary parallel plates.

A MT-07, Pg. No. 46

34. What is the difference between plane-couette flow and plane posieuille flow?

A MT-07, Pg. No. 46

35. How do you explain a back flow in case of generalized coquette flow?

A MT-07, Pg. No. 49

36. Write the equation of velocity distribution in a generalized plane coquette flow and discuss the three cases for nature of pressure gradient.

A MT-07, Pg. No. 49

37. Define volume rate of flow for generalized plane coquette flow.

A MT-07, Pg. No. 49

38. Discuss coefficient of skin friction when flow is in a circular pipe.

A MT-07, Pg. No. 52

39. Write down the velocity and volume rate for tube of circular cross-section.

A MT-07, Pg. No. 54

40. Distinguish between Hiemenz flow and karman flow.

A MT-07, Pg. No. 64

41. What do you mean by Hiemenz flow and karman flow? Write a short note on :
    (a) Stagnation point
    (b) Boundary layer

A MT-07, Pg. No. 64

42. Discuss about the concept of undteady flow.

A MT-07, Pg. No. 71

43. Write stoke's first problem with initial and boundary condition.

A MT-07, Pg. No. 72

44. Define Rayleigh problem.

A MT-07, Pg. No. 74

45. Figure out velocity profile for stoke's first problem and stoke's second problem.

A MT-07, Pg. No. 73,75

46. What is the difference between stoke's first problem and stoke's second Problem? Give the definitions of unsteady motion and startup flows.

A MT-07, Pg. No. 71

47. Show that penetration depth is proportional to the square roost of the product of viscosity & time.

A MT-07, Pg. No. 73

48. Define :

(a) Suction
(b) Injection
(c) Starting flow

A MT-07, Pg. No. 76

49. Describe starting flow in plane coquette motion.

A MT-07, Pg. No. 76

50. Discuss flow between two parallel porous plates.

A MT-07, Pg. No. 78

51. Write about plane coquette flow with porous wall.

A MT-07, Pg. No. 79

52. What do you mean by porous boundaries? Distinguish between two flow problems:
(a) Flow between two parallel porous plates.

(b Plane coquette flow with porous walls.

A MT-07, Pg. No. 78,79

53. What is Nusselt number? Discuss temperature distribution.

A MT-07, Pg. No. 81

54. Write the relation between Nusselt number, Eckert number and Prandtl number and discuss the cases of heat transfer between fluid and upper plate for plane coquette flow.

A MT-07, Pg. No. 83

55. Discuss temperature distribution in a pipe.

A MT-07, Pg. No. 87

56. Calculate the unweighted mean temperatures and weighted mean temperature and write Nusselt number for both.

A MT-07, Pg. No. 91

57. Write a short note on the theory of very slow motion with reference to stoke's flow past a sphere.

A MT-07, Pg. No. 96

58. Show that drag on a sphere of radius r for the stoke's flow past the sphere is $6\pi r\mu \cup_{\infty}$ Where notations have their usual meaning.

A MT-07, Pg. No. 99

59. Define stoke's stream function and also write the stream function of the superimposed flow.

A MT-07, Pg. No. 100

60. Express stream function Ψ as composed of two parts Ψ_1 *and* Ψ_2 and write their physical significance.

A MT-07, Pg. No. 100

61. How Oseen's method is an improvement on the method of stokes.

A MT-07, Pg. No. 101

62. Write Oseen's equation. Describe a short note on it.

A MT-07, Pg. No. 101, 102

63. Define stream function for Oseen's flow.

A MT-07, Pg. No. 104

64. Discuss the distinction between Oseen's flow from stoke's flow in flow pattern by figuring out stream lines of both flows.

A MT-07, Pg. No. 100,105

65. Write a short note on 'What Prandtl did in the development of fluid mechanics?

A MT-07, Pg. No. 106

66. Write a short note on Prandtl's boundary layer theory.

A MT-07, Pg. No. 106

67. What do you mean by no-slip conditions? How can the flow past a body be partitioned into two regions according to Prandtl's theory.

A MT-07, Pg. No. 107

68. Briefly outline the application of boundary layer theory.

A MT-07, Pg. No. 107

69. Write a short note on Thermal Boundary layer.

A MT-07, Pg. No. 114

70. Write the boundary layer equations for undteady two dimensional incompressible flow over a solid plane wall in view of magnitude analysis.

A MT-07, Pg. No. 112

71. Obtain series solution for $f(\eta)$ about η = 0.

A MT-07, Pg. No. 118

72. Wite short note on :
    (a) Blasius-Topfer solution

    (b) Croccos first integral