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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (R, S) / S1 (PT) (S, FE) Examination December 2023 (2019 Scheme)

Course Code: MET203

Course Name: MECHANICS OF FLUIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1	Determine the viscosity of a fluid having kinematic viscosity 6 stokes and specific gravity 1.9.	(3)
2	Explain the states of equilibrium of a floating body.	(3)
3	Show that in a 2D flow, stream lines and equipotential lines are intersect orthogonally.	(3)
4	Explain total, convective and local acceleration.	(3)
5	State why the length of divergent cone in a venturimeter is made longer.	(3)
6	Explain the working principle of pitot static tube with a neat sketch.	(3)
7	Explain briefly major and minor losses in pipes.	(3)
8	Explain the term hydraulic gradient line and energy gradient line.	(3)
9	Differentiate between laminar and turbulent boundary layers.	(3)
10	Define: Reynold's Number, Euler Number, Mach Number.	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11	How fluids can be classified based on its rheological properties.	(4)
12	The velocity distribution over a plate is parabolic and is given as $u = ly^2 + my + n$ with free stream velocity of 180 cm/s occurring at vertex 30 cm from the plate. Draw the velocity profile and calculate the velocity gradients and shear stress at a distance of 0, 15, 30 cm from the plate. Take the viscosity of fluid as 9 poise.	(10)

Module 2

13	Define the following with example. i) Stream lines ii) Stream tube iii) Path lines iv) Streak lines	(4)

14 The velocity potential function for a two-dimensional flow is $\Phi=x(2y-1)$ at a point P (1,4) determine: (10)

1) The velocity and
2) The stream function

Module 3

15 Derive Euler's equation of motion. Obtain Bernouli's equation from Euler's equation. What are the assumptions made in deriving Bernoulli's equation? (7)

16 A submarine moves horizontally in sea. A pitot static tube placed just in front of the submarine is connected to two limbs of a U tube manometer containing mercury. The difference of mercury level is found to be 170 mm. Find the speed of the submarine knowing that the specific gravity of mercury is 13.6 and that of sea water is 1.026. (7)

Module 4

17 Prove that velocity distribution in a fully developed laminar flow through a circular pipe is parabolic and the average velocity is half that of the maximum velocity. (7)

18 Glycerine flows at a velocity of 5 m/s in a 10 cm diameter pipe. Dynamic viscosity and density of glycerine is assumed as 1.50 Pa.s and 1260 kg/m^3 respectively. Estimate: i) The boundary shear stress in the pipe due to the flow. ii) Head loss in a length of 10 m of pipe. iii) Power developed by the flow in a distance of 10 m. (7)

Module 5

19 Describe any two methods of preventing the separation of boundary layer. (7)

20 Using Buckingham's π theorem show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\emptyset\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ where H is the head causing flow, D is the diameter of the orifice, μ is the co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. (7)

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