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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (R,S) / S3 (WP) (R,S) / S1 (PT) (S,FE) Examination November 2024 (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	What is viscosity. What is the cause of it in liquids and in gases. Discuss the effect of temperature on viscosity of Liquid and Gas.	(3)
2	A reservoir of Glycerin has a mass of 1200 kg and a volume of 0.952 m^3. Find the mass density, specific weight, and specific gravity.	(3)
3	Differentiate between the Eulerian and Lagrangian approaches of fluid flow.	(3)
4	Define metacentre and metacentric height.	(3)
5	Differentiate between Notches and Weirs.	(3)
6	An oil (ρ = 800 kg/m^3) is flowing through a Venturi meter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a difference of pressure head of 240 cm of oil. Calculate the discharge of oil through the horizontal Venturi meter (Take Cd=0.98) in m^3/sec.	(3)
7	Define Reynold's number, what is the significance of Reynold's number.	(3)
8	Define the terms Water hammer and Cavitation.	(3)
9	With a neat sketch, show the formation of boundary layer over a smooth flat plate which is placed parallel to the direction of flow having free stream velocity (U).	(3)
10	Explain a) Reynolds Model law b) Froude Model Law.	(3)

PART B

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

Module 1

11	A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30^0 with the free surface of water. Determine the total pressure and position of centre of pressure when the upper edge is 1.5 m below the free water surface.	(14)

12 A differential manometer is connected at the two points A and B of two pipes. The pipe A contains a liquid of sp. gr.= 1.5 while pipe B contains a liquid of sp. gr.= 0.9 The pressures at A and B are 98.10 kN/m^2 and 176.580 kN/m^2 respectively. Find the difference in mercury level in the differential manometer. Pipe A is 3 m above pipe B. The mercury level in the limb connected to pipe A is 2 m below the center line of pipe B. The level of mercury in the limb connected to pipe B is below the level of mercury (Sp.gr. = 13.6) in the other limb. (14)

Module 2

13 (a) Derive the general continuity equation in three dimensions Cartesian coordinates and deduce the equation for steady incompressible fluid flow. (10)

(b) The fluid velocity components are given by **u = x- 4y** and **v = -y - 4x,** in a 2D incompressible flow, Show that it's a case of possible fluid flow. (4)

14 The velocity potential function Φ is given by $2x^3y - 2xy^3$. Calculate the velocity components and the value of stream function at point (3, 2). (14)

Module 3

15 (a) State Bernoulli's equation. What are the assumptions made in deriving Bernoulli's equation. (6)

(b) Derive Euler's equation of motion and obtain Bernoulli's equation from Euler's equation. (8)

16 An orifice meter (co- efficient of discharge = 0.64) with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil (sp. gr. 0.9) differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil. (14)

Module 4

17 Explain Moody's Chart. Establish relation between friction factor is independent of the Reynolds number. (14)

18 (a) Define hydraulic gradient line and total energy line. (6)

(b) An existing compound piping system to transport water from one station to another station consists of 1800 m of 50 cm, 1200 m of 40 cm and 600 m of 30 cm diameter pipes of same material connected in series. It is decided to change these existing pipes with new pipes of uniform diameter. Calculate diameter of new pipes to be used so as maintain same discharge and loss of head as in previous situation. (8)

Module 5

19 (a) List out and explain forces acting in a moving fluid. (4)

(b) Define the following; (10)

i. Reynold's Number

ii. Froude's Number

iii. Euler's Number

iv. Weber's Number

v. Mach's Number

20 What is meant by boundary layer separation. What are the different methods of preventing boundary layer separation. (14)

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