Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: ME212

Course Name: FLUID MECHANICS (MA)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions, each carries 10 marks. Marks

1 a) Differentiate Specific Volume, Specific weight and Specific Gravity of a fluid (3)

b) Two large plane surfaces are 2.4 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of surface area 0.5 m^2 between the two large plane surfaces at a speed of 0.6 m/s, if: (7)

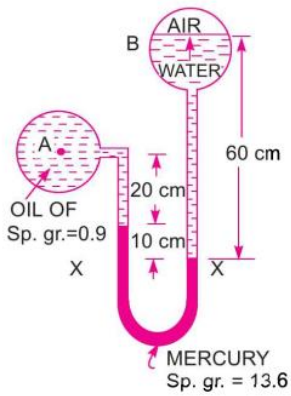
(i) the thin plate is in the middle of the two plane surfaces, and

(ii) the thin plate is at a distance of 0.8 cm from one of the plane surfaces?

Take the dynamic viscosity of glycerine as 8.1×10^{-1} Ns/m^2.

2 a) Explain the stability of floating bodies. (3)

b) A differential manometer is connected at two points A and B as shown in figure. The air pressure (absolute**)** at B is 9.81N/cm^2. Find the absolute pressure at A.



(7)

3 a) Define Stream line, Stream tube and Streak line. (3)

b) The velocity vector in a fluid flow is given by $V= 5x^3 i - 10x^2y j + 3t k$; Find the velocity and acceleration of a fluid particle at (1, 2, 3) at time t=1. (7)

4 a) Differentiate Stream function and Velocity potential function (3)

b) A stream function in a two dimensional flow is ψ= 4xy. Show that the flow is irrotational and determine the corresponding velocity potential function ϕ. (7)

PART B

Answer any three questions, each carries 10 marks.

5 a) Derive Euler's equation and hence form Bernoulli's theorem, mentioning clearly the assumptions underlying it. (8)

b) Differentiate between notches and weirs (2)

6 a) Derive the relation connecting hydraulic coefficients of an orifice (4)

b) An Orifice meter with orifice diameter 10 cm is inserted in a pipe of diameter 20 cm diameter. The pressure gauges fitted at the upstream and downstream of the orifice meter gives reading of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Cd=0.6 Find the discharge of water through pipe. (6)

7 a) What is law of fluid friction for turbulent flow? (4)

b) Derive an expression for Hagen Poiseuille's formula. (6)

8 a) Differentiate Hydraulic Gradient Line and Total Energy Line. (4)

b) Derive an expression to find the power transmission through pipes. Also find the condition for maximum efficiency. (6)

PART C

Answer any four questions, each carries 10 marks.

9 Draw a neat diagram and explain the concept of boundary layer development along a long thin plate. Describe the details of various regions in the boundary layer. (10)

10 a) Define energy thickness. (4)

b) Derive an expression for the energy thickness. (6)

11 a) Explain the effect of pressure gradient on separation of boundary layer. (3)

b) Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate and u = U at y = δ, where δ= boundary layer thickness. (7)

12 a) State Buckingham's π theorem and mention the conditions for selecting repeating variables. (5)

b) Derive the expression for the power P, developed by a pump when P depends on head H, discharge Q and specific weight w of the fluid. (5)

13 a) Differentiate Geometric similarity and Dynamic similarity. (4)

b) Water is flowing through a pipe of diameter 40cm at a velocity of 3m/s. Find the velocity of oil flowing in another pipe of diameter 10cm, if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.001Pa s and 0.003 Pa s. Sp. gravity of oil = 0.85 (6)

14 a) Differentiate between Froude number and Weber number. (4)

b) A 1:20 model of a flying boat is towed through water. The proto type is moving in sea water of density 1024kg/m^3at a velocity of 25m/s. find the corresponding speed of the model. Also determine the resistance due to waves on model if the resistance due to waves of prototype is 700N. (6)

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