Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CH205

Course Name: FLUID AND PARTICLE MECHANICS-I

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Explain the phenomena of capillarity. Obtain an expression for the capillary rise or fall for a given fluid. (5)

b) Discuss the causes of viscosity. Also give the rheological classification of fluids. (5)

c) Find the kinematic viscosity of an oil having density 892 kg/m^3. The shear stress at a point in oil is 0.2051 N/m^2 and velocity gradient at that point is 0.3/sec. (2.5)

d) Calculate the specific mass, specific weight and specific volume of one litre of petrol of specific gravity 0.6. (2.5)

2 a) Detail the significance of metacentre and metacentric height. (5)

b) State the principles of continuous gravity decanter and centrifugal decanter. (6)

c) Explain lapse rate. State an expression for determining the lapse rate. (4)

3 a) The right limb of a simple U-tube manometer containing mercury is open to atmosphere and the left limb is connected to a pipe through which flows a fluid of specific gravity 0.8. Make calculations for the vacuum pressure if the difference of mercury level in the two limbs is 30 cm and the level of fluid in the left limb is 10 cm below the centre of pipe. (7.5)

b) Two coaxial cylinders, 10 cm and 9.75 cm in diameter, and 2.5 cm high have both their ends open and have a viscous liquid filled in between. A torque of 1.2 N m is produced on the inner cylinder when the outer one rotates at 90 rpm. Determine the coefficient of viscosity. (7.5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Estimate the transition length at the entrance to a 15 mm tube through which 100% glycerol at 60^{0}C is flowing at a velocity of 0.3 m/s. The density and viscosity of glycerol are 1240 kg/m^3 and 98 cP respectively. (7)

b) Differentiate the Eulerian and Lagrangian methods for the analysis of flow. (4)

c) Define the terms: Stream line, Path line, Stream tube and Streak line (4)

5 a) Starting from fundamental, derive the Navier-Stokes equation and its application. (10)

b) A pipe with 9m long is inclined at an angle of 30° with the horizontal. The smaller section of the pipe which is at the lower level has a diameter of 130mm and the larger section of the pipe is of 360mm dia. If the pipe is uniformly tapering and the velocity of the water at the smaller section is 0.9 m/s, determine the pressure differences between two sections. (5)

6 a) Derive the continuity equation from fundamental principles. (10)

b) Explain the terms i) circulation and ii) vorticity in flow (5)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive Hagen-Poiseulle's equation for a pressure drop over a length of pipe line. (10)

b) Explain the working of i) Rotameter ii) Triangular notch (6)

c) Derive an expression for shear stress distribution for fully developed flow through a horizontal pipe.

8 a) Write the velocity distribution for turbulent flow in smooth pipes by prandtl one seventh power law. (3)

b) State the different types of friction factors and explain the use and features of friction factor chart. (5)

c) A horizontal pipe, 10 cm in diameter is joined by sudden enlargement to a 15 cm diameter pipe. Water is flowing through it at the rate of 2 m^3/min. Find the loss of head due to abrupt expansion and the pressure difference in the two pipes. If the change of section is gradual without any loss, what would be the change in pressure? (12)

9 a) Explain the different types of valves employed in process industries. (10)

b) Derive the expression for volumetric flow rate of a fluid in an orifice meter with known dimensions if a manometer is connected to measure the pressure drop. (10)

****