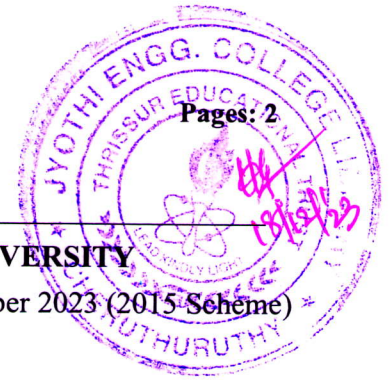C   08000CE203122001   Pages: 2

Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S3 (S, FE) / S1 (PT) (S, FE) Examination December 2023 (2015 Scheme)

Course Code: CE203
Course Name: FLUID MECHANICS - I

Max. Marks: 100   Duration: 3 Hours

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

1 a) Differentiate between absolute pressure and gauge pressure with a sketch.   (5)

   b) A solid cylinder of diameter 4 m has a height of 4 m. Find the metacentric height   (10)
   of the cylinder if the specific gravity of the material of the cylinder is 0.6 and it is
   floating in water with its axis vertical. State whether the equilibrium is stable or
   unstable.

2 a) With neat sketches, explain the conditions of equilibrium for submerged bodies.   (6)

   b) The stream function for a 2 dimensional flow is given by $\Psi = 2xy$. Calculate the   (9)
   velocity at the point P (2, 3). Also find the velocity potential function.

3 a) What is a flow net? Give any three uses of flow net.   (5)

   b) A tank contains water upto a height of 0.5 m above the base. An immiscible liquid   (10)
   of specific gravity 0.8 is filled on the top of the water upto 1 m height. Calculate
   the total pressure on one side of the tank and the position of centre of pressure for
   one side of the tank, if the tank is 2 m wide.

PART B

Answer any two full questions, each carries 15 marks.

4 a) If Q is the discharge and H is the head over the triangular weir, prove that the error   (6)
   in discharge due to error in the measurement of head over the weir is given
   by $\dfrac{dQ}{Q} = \dfrac{5}{2}\dfrac{dH}{H}$.

   b) A discharge of 2000 m³/s is to pass over a rectangular weir. The weir is divided   (9)
   into a number of openings each of span 10 m. If the velocity of approach is 4 m/s,
   find the number of openings needed so that the head of water over the crest is not
   to exceed 2 m.

5 a) Derive an expression for discharge through a fully submerged orifice (5)

   b) In a 45° bend, a rectangular air duct of 1 m^2 cross sectional area is gradually (10)
       reduced to 0.5 m^2 area. Find the magnitude and direction of the force required to
       hold the duct in position, if the velocity of flow in the 1 m^2 section is 10 m/s and
       pressure is 2.943 N/cm^2. The density of air is 1.16 kg/m^3.

6 a) What is momentum correction factor? (4)

   b) Derive the equation for velocity measurement using a pitot tube. (4)

   c) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is (7)
       used to measure the flow of oil of specific gravity 0.8. The discharge of oil
       through venturimeter is 60 l/s. Find the reading of the oil – mercury differential
       manometer. Take $C_d = 0.98$

PART C

Answer any two full questions, each carries20 marks.

7 a) Distinguish between Hydraulic gradient line and Total energy line (5)

   b) Water at 15° C flows between two large parallel plates at a distance of 1.6 mm (8)
       part. Find the maximum velocity, pressure drop per unit length and the shear stress
       on the walls of the plate if the average velocity is 0.2 m/s. Viscosity of water at the
       temperature is 0.01 Poise.

   c) Determine the difference in elevation between the water surfaces in two tanks (7)
       connected by a horizontal pipe of diameter 300 mm and length 400 m. The rate of
       flow of water through the pipe is 300 l/s. Consider all losses and take f = 0.008

8 a) What is Moody's diagram? What is its use? (7)

   b) Find the displacement thickness, momentum thickness and energy thickness for (13)
       the velocity distribution in the boundary layer given by $\dfrac{u}{U} = \dfrac{y}{\delta}$

9 a) What is meant by boundary layer separation? Give any four methods to control it. (7)

   b) A truck having a projected area of 12 m^2 travelling at 60 kmph has a total (13)
       resistance of 2943 N. Of this 25% is due to rolling friction and 15% is due to
       surface friction. The remaining is due to form drag. Calculate the coefficient of
       form drag if the density of air is 1.25 kg/m^3.

****