3E1133

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B. Tech. III - Sem. (Main) Exam., Dec. - 2018
PCC Civil Engineering
3CE406 Fluid Mechanics

Time: 2 Hours **Maximum Marks: 80**

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only) **[5×2=10]**

All questions are compulsory

Q.1 State Newton's law of viscosity.

Q.2 What do you understand by total pressure and center of pressure?

Q.3 Define compressibility.

Q.4 Define vena-contract.

Q.5 What do you understand by kinetic energy correction and momentum correction factors?

PART – B

(Analytical/Problem solving questions) **[4×10=40]**

Attempt any four questions

Q.1 Derive an expression for the depth of center of pressure from free surface of liquid of an inclined plane surface submerged in liquid.

Q.2 If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$. Determine the velocity at the point P (4, 5). Also determine the value of stream function ψ at the point P.

Q.3 A differential manometer is connected at two points A and B of two pipe as shown in fig. no. 1. The pipe A contains a liquid of sp. gravity = 1.5 while pipe B contains a liquid of sp. gravity = 0.9. The pressure at A and B are 1 kgf/cm^2 and 1.8 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer.

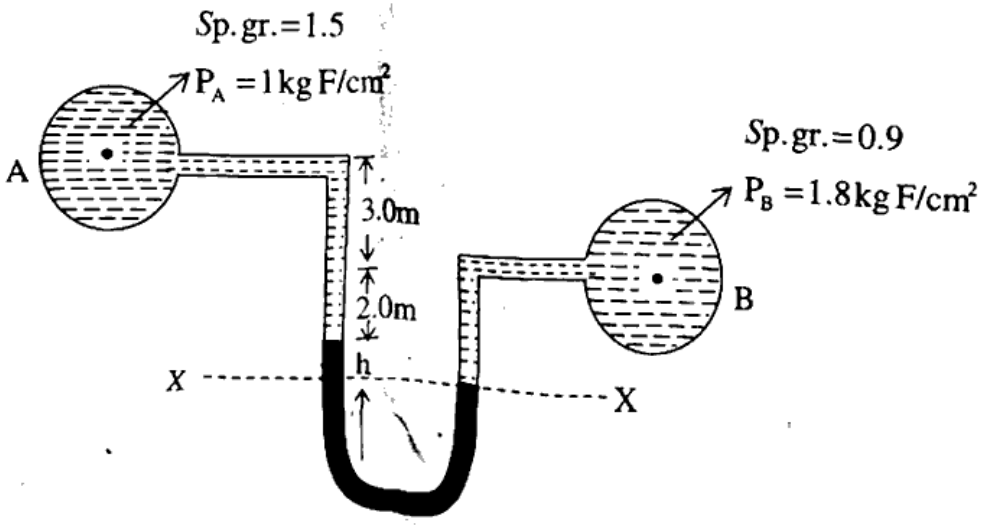

Fig - No. - 1

[3E1133] **[5060]**

Q.4 What is a venturimeter? Drive an expression for the discharge through venturimeter.

Q.5 A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds.

Q.6 A reducer bend having an outlet diameter of 15 cm discharge freely. The bend connected to a pipe of 20 cm diameter, has deflection of 60° and lies in a horizontal plane. Determine the magnitude and direction of force on the anchor block supporting the pipe when discharge of 0.3 m^3/s passes through the pipe.

PART – C

(Descriptive/Analytical/Problem Solving/Design Question) **[2×15=30]**

Attempt any two questions

Q.1 A horizontal pipe line 40 m long is connected to a water tank at one end and discharge freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take F = 0.01 for both sections of the pipe.

Q.2 Find the convective acceleration at the middle of a pipe which converges uniformly from 0.4 m diameter to 0.2 m diameter over 2 m length. The rate of flow is 20 l/s. If the rate of flow changes uniformly from 20 l/s. to 40 l/s in 30 seconds, find the total acceleration at the middle of the pipe at 15th second. [7]

Q.3 (a) Drive an expression metacenter height of the floating body.

(b) 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° with free surface of water. Determine the total pressure and position of center when the upper edge is 1.5 m below the free water surface. *[8]*
