Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20256

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third Semester

Civil Engineering

CE 6303 — MECHANICS OF FLUIDS

(Common to Environmental Engineering)

(Regulations 2013)

(Also common to PTCE 6303 – Mechanics of Fluids for B.E. (Part-Time) – Second Semester – Civil Engineering – Regulations – 2014)

Time : Three hours Maximum : 100 marks

Assume suitable data if found necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

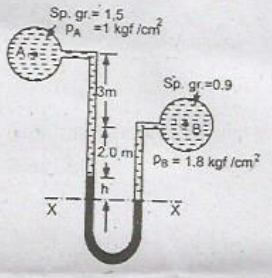
1. Define surface tension.
2. Compare gauge pressure and vacuum pressure.
3. What do you understand by Continuity Equation?
4. Give the assumptions made in the derivation of Bernoulli's equation.
5. What does Haigen-Poiseulle equation refer to? Also write its equation.
6. Compare H.G.L. and T.E.L.
7. Define boundary layer thickness.
8. Enlist the methods of preventing the separation of boundary layers.
9. What do you mean by dimensionally homogeneous equation?
10. Distinguish between undistorted and distorted models.

PART B — (5 × 13 = 65 marks)

11. (a) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 r.p.m., determine the viscosity of the fluid. (13)

Or

(b) A differential manometer is connected at the two points A and B of two pipes as shown in Fig. The pipe A contains a liquid of sp. gr. = 1.5 while pipe B contains a liquid of sp. gr. = 0.09. The pressures at A and B are 1 kgf/cm² and 1.80 kgf/cm² respectively. Find the difference in mercury level in the differential manometer.



12. (a) The following cases represent the two velocity components, determine the third component of velocity such that they satisfy the continuity equation

(i) $u = x^2 + y^2 + z^2$; $v = xy^2 - yz^2 + xy$

(ii) $v = 2y^2$, $w = 2xyz$. (13)

Or

(b) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm² and the yacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take $C_d = 0.98$. (13)

13. (a) 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 cm. 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. (13)

Or

(b) Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4 m above the center of the pipe. Consider all minor losses and take f = 0.009. (13)

14. (a) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$, where δ = boundary layer thickness. (13)

Or

(b) For the velocity profile in laminar boundary layer as $u/U = 3/2(y/\delta) - 1/2(y/\delta)^3$. Find the thickness of the boundary layer and the shear stress 1.5 m from the leading edge of a plate. The plate is 2 m long and 1.4 m wide and is placed in water which is moving with a velocity of 200 mm per second. Find the total drag force on the plate if μ for water = 0.01 poise. (13)

15. (a) The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l, velocity V, air viscosity μ, air density ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force. (13)

Or

(b) A 1:64 model is constructed of an open channel in concrete which has Manning's N = 0.014. Find the value of N for the model. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A pipe of diameter 0.4 m and of length 2000 m is connected to a reservoir at one end. The other end of the pipe is connected to a junction from which two pipes of lengths 1000 m and diameter 300 m run in parallel. These parallel pipes are connected to another reservoir, which is having level of water 10 m below the water level of the above reservoir. Determine the total discharge if f = 0.015. Neglect minor losses. (15)

Or

(b) The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's Π-theorem, obtain an expression for Δp. (15)