Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

CIVIL ENGINEERING

Third Semester

CE 8351 - FLUID MECHANICS

(Regulation 2012)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Derive dimensions for Bulk modulus (k) and kinematic viscosity.
2. What do you mean by relative equilibrium in fluid statics?
3. State the assumptions made in derivation of Bernoulli's equation.
4. What is streamline? and how it is different from steak line.
5. Brief about Rayleigh's method.
6. Enlist the different dimensionless numbers
7. What do you mean by eddy and vena contracta in pipe flow?
8. What is Moody diagram and state its use in pipeflow?
9. What is sub-laminar boundary layer?
10. Define steady molecular diffusion.

Part – B (5 x 16 = 80 marks)

11. (i) Derive Von-karman momentum equation for boundary layer flow. (16)

12. a) (i) Find the height through which water rises by capillary action in a glass tube of 2 mm bore if the surface tension at the prevailing temperature is 0.075 g/cm. (6)
(ii) An Inverted 'U' tube is connected across two pipes A and B carrying fluids. Pipe B contains water and pipe A contains liquid of sp.gravity 1.1. The sp.gr of manometric liquid is 0.7. The liquid in pipe A rise upto 20 cm and in pipe B raises upto 35 cm. If the level difference between pipe A and pipe B is 10 cm, calculate the pressure difference between the pipes. (10)

(OR)

b) The gates of a lock are 5 m wide and 5 m high and, when closed, include an angle of 120°. Each gate is held on two hinges, one placed at the top and the other at the bottom of the gate. If the water levels are 4.5 m and 3 m on the upstream and downstream sides respectively, determine the magnitude of the forces on the hinges due to the water pressure.

13. a) The velocity components in a two dimensional flow field for an incompressible fluid are expressed as

$$u = \frac{y^3}{3} + 2x - x^2y, \quad v = xy^2 - 2y - \frac{x^3}{3}$$

(1) show that these functions represents a possible case of an irrotational flow, (2) obtain an expression for the stream function and (3) obtain an expression for the velocity potential

(OR)

b) The diameter of a pipe bend is 0.35 m at inlet and 0.2 m at outlet and the flow is turned through 120° in a vertical plane. The axis at inlet makes an angle of 50° to horizontal and the centre of the outlet section is 1 m below the centre of the inlet section. The total volume of fluid contained in the bend is 0.125 m^3. Due to losses of energy between inlet and outlet 0.2 m of head is lost. Calculate the magnitude and direction of the force exerted on the bend by the water flowing through it at 225 l/s when the inlet pressure is 137.34 kN/m^2.

14. a) Using Buckingham's pi theorem, show that the discharge consumed by an oil ring is given by

$$Q = Nd^3\phi\left[\frac{\mu}{\rho Nd^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{w}{\rho N^2 d}\right]$$

Where d is the internal diameter of the ring, N is rotational speed, ρ is density, μ is viscosity, σ is surface tension and w is the specific weight of oil.

(OR)

b) A ship 150 m long moves in fresh water at 36 km/hr. A 1:100 model of this ship is to be tested in a towing basin containing a liquid of sp.gr.0.90. What viscosity must this liquid have for both Reynolds and Froude model law to be satisfied? At what speed must the model be towed? If 117.7 Watts is required to tow the model at this speed, what power is required by the ship? Take viscosity of water as 0.00113 Ns/m^2.

15. a) Derive an expression for steady laminar flow in circular pipes and prove that the Umax/V=2, and head loss between two sections is 32 ν V L/(g D2), where ν is kinematic viscosity. Draw the necessary sketch. (16)

(OR)

b) A pipe having a length of 8 km and diameter 0.70 m connects two reservoirs A and B, the difference between their water levels is 30 m. Halfway along the pipe there is a branch through which water can be supplied to a third reservoir C. Taking friction factor as 0.024 determine the rate of flow of reservoir B when (1) no water is discharged to reservoir C; (2) the quantity of water discharged to reservoir C is 0.15 m^3/s. Neglect minor losses. (16)