M156

B.E./B.TECH. DEGREE EXAMINATIONS, MAY/JUNE-2011

REGULATIONS 2007

THIRD SEMESTER

CE 1203 – MECHANICS OF FLUIDS

CIVIL ENGINEERING

Time: Three Hours Maximum: 100 marks

ANSWER ALL QUESTIONS

PART-A (10×2=20 marks)

1. Differentiate between cohesive and adhesive forces with reference to surface tension property of fluids.
2. Derive the dimensions of dynamic viscosity in MLT.
3. Write the continuity equation in three dimensional form.
4. What are steady and unsteady flows?
5. State Euler equation of fluid motion.
6. Sketch the shear stress distribution across pipe flow.
7. Bring out the hydraulic characteristics of pipes in parallel.
8. Define momentum thickness.
9. Highlight the properties of repeated variables.
10. Enlist the uses of model studies.

PART—B (5×16=80 marks)

11. (a) (i) With usual notations, derive Newton's equation of viscosity. (8)

(ii) Explain the property of compressibility of fluid. The volume of a liquid is reduced by 1% through increasing the pressure from 5 Atm to 125 Atm. Find the modulus of elasticity of the liquid. (8)

Or

(b) (i) With usual notations, derive an expression for pressure difference between inside and outside of an air bubble, based on surface tension. (8)

(ii) A hydraulic lift used for lifting automobiles has a 25 cm dia. ram which slides in a 25.02 cm dia. cylinder. The annular space being filled with oil having a kinematic viscosity of 3.7 cm^2/s and relative density of 0.9. If the rate of travel (8)

of ram is 15 cm/s find the frictional resistance when 3m length of ram is engaged in the cylinder

12. (a) (i) State the hydrostatic equation. Prove that the total pressure exerted by a static liquid on an inclined plane submerged surface is same at the force exerted on a vertical plane surface, as long as the depth of center of gravity of the surface is unaltered. (8)

(ii) What is velocity potential function? Also, derive Laplace equation from it. (8)

Or

(b) (i) Briefly discuss the various pressure measurement devices. (8)

(ii) Explain how pivot meter is used to measure the velocity in a steam. (8)

13. (a) (i) With usual notations, derive Euler's equation. (8)

(ii) Define Reynolds number and also, give a general expression for the same. A laminar fully developed flow of oil take place through a 25 mm pipe with a maximum velocity of 2m/s. the dynamic viscosity of the oil is 0.07 N.s/m^2. Calculate the pressure drop over a length of 50m. (8)

Or

(b) (i) Compare and contrast venture and orifice meters. (8)

(ii) With usual notations, derive Darcy-Weisbach equations. (8)

14. (a) (i) Appropriately define the boundary layer concept. A smooth plate 3 m wide and 30 m long is towed through still water with a speed of 6 m/s. find the boundary layer thickness at 27 m from the leading edge of the plate. Take kinematic viscosity as 1µm^2/s. (8)

(ii) With usual notations, derive turbulent boundary layer thickness. (8)

Or

(b) (i) With usual notations, derive laminar boundary layer thickness. (8)

(ii) A 145 m long of 45 cm dia, concrete pipe and a 180 m long of 30 cm dia. concrete pipe is connected in series. Calculate the length of an equivalent pipe of 25 cm diameter. (8)

15. (a) (i) Mention the drawbacks of Rayleigh's index method. The discharge through the horizontal tube is thought to depend on the pressure drop per unit length, the diameter, and the dynamic viscosity. Find the form of equation, using the Rayleigh's index method. (8)

(ii) Discuss about models and similitude. (8)

Or

(b) (i) Explain the procedural steps adopted in Backingham's Π method. (8)

(ii) What is dynamic similarly? Water is flowing through a pipe of diameter 10 cm at a velocity of 4 m/s. Find the velocity of oil flowing in another pipe of diameter 10 cm, if the condition of dynamic similarity is satisfied. The specific gravity of oil is 0.8 and its viscosity is 2.5 times that of water. (8)