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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Third Semester

Civil Engineering

CE 233 — FLUID MECHANICS

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   State Pascal's Law.

2.   Differentiate Cohesion and Adhesion.

3.   Write the condition of floating body w.r.t. centre of gravity and meta centre.

4.   What is the pressure within a droplet of water 0.05 mm in diameter, if the pressure outside the droplet is standard atmospheric pressure of 1.03 kgf/cm²?

5.   Define Convective and Local Acceleration

6.   Define stream function.

7.   What is meant by the term dimensional homogeneity?

8.   What is scale effect in model study?

9.   Differentiate Lagrangian and Eulerian methods of fluid flow analysis.

10. A compound piping system consists of 1800 m of 0.5 m and 1200 m of 0.4 m a new cast iron pipes connected in series. Convert the system to an equivalent length of 0.4 m pipe.

11. (i) If the equation of a velocity distribution over a plate is given by $u = 2y - y^2$, in which u is the velocity in m/s at a distance y, measured in meters above the plate, what is the velocity gradient at the boundary and at 7.5 cm and 15 cm from it? Also determine the shear stress at these points if absolute viscosity $\mu = 8.6$ poise. (8)

   (ii) Explain briefly the types of fluids, based on viscosity of fluid. (8)

12. (a) Find the horizontal and vertical component of the hydrostatic forces on the cylinder (Figure below) of length 6.75 m having diameter 2.3 m.
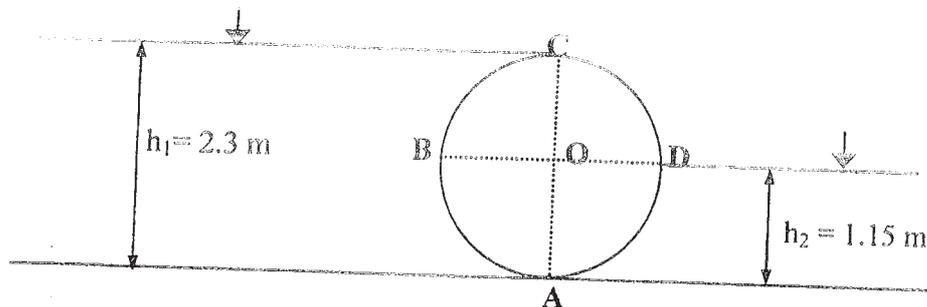
Or

   (b) (i) A cylindrical buoy 1.35 m in diameter and 1.8 m high has a mass of 770 kg. Show that it will not float with its axis vertical in sea water of density 1025 kg/m³. (12)

   (ii) List the types of fluid flow. (4)

13. (a) (i) If the velocity components of two dimensional flow are given by $u = x/(x^2 + y^2)$; and $v = y/(x^2 + y^2)$, check for flow to be continuous and determine acceleration components a_x and a_y. Find the resultant total acceleration at (2, 3). (8)

   (ii) Derive the expression for the loss of head due to friction in a pipeline. (8)

Or

   (b) Derive the expression for Euler's equation of motion for a steady flow of an ideal fluid. Using Euler's equation derives the Bernoulli's equation and states its assumptions. (16)

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14. (a) A pipeline connecting two reservoirs having a difference of water level of 6 m is 720 m Long, and rises to a height of 3 m above the upper reservoir water level at a distance of 240 m from the entrance before falling to the lower reservoir. If the pipe is 1.2 m in diameter and frictional coefficient $f = 0.01$, what will be the discharge and the pressure at the highest point of the pipeline? Neglect entry and exit losses. (16)

Or

(b) Two reservoirs with a difference in water levels of 180 m are connected by a 64 km long pipe of 600 mm diameter and 4 f of 0.015. Determine the discharge through the pipe. In order to increase this discharge by 50%, another pipe of the same diameter is to be laid from the lower reservoir for part of the length and connected to the first pipe. Determine the length of additional pipe required. (16)

15. (a) A seashore platform is known to encounter waves 4.5 m high at a frequency of 0.15 Hz and a steady current 1.5 m/sec. If a 1/25 scale model of the platform is to be built and sea water is used, determine the above particulars for the model. (16)

Or

(b) The resisting force of a supersonic aircraft during its flight can be assumed to depend on following variables length, velocity, viscosity, density and bulk modulus. With the help of Buckingham theorem derive an expression showing the relationship between the resisting force and these variables. (16)

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