C 26874

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Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION MARCH/APRIL 2012

CE 09 403/ PTCE 09 402—FLUID MECHANICS

(2009 Admissions)

Time : Three Hours

Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Define vorticity.
2. What is stagnation pressure ?
3. What is meant by a distorted model ?
4. Define total energy line.
5. What is meant by boundary layer thickness ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. What are the different conditions of equilibrium of a floating body ?
7. Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm the rate of flow of water through the pipe is 250 litres/s
8. Describe the uses of flow nets.
9. An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 litres/s find the head lost due to friction and power required to maintain the flow for a length of 1000 m take $v = 0.29$ stokes.
10. Distinguish between free and forced vertex flow.
11. Explain the formation of boundary layer over a flat plate.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions, each question carries* 10 *marks.*

12. (a) (i) Two plates are placed at a distance of 0.15 mm apart. The lower plate is fixed while the upper plate having a surface area 1.0 m^2 is pulled at 0.3 m/s. Find the force and power required to maintain this speed, if the fluid separating them is having a viscosity of 1.5 poise

Turn over

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(ii) Derive an expression for the depth of centre of pressure from the free surface of liquid of an inclined plane surface submerged in a liquid.

Or

(b) A cone of specific gravity S is floating in water with its apex down wards. It has a diameter D and vertical height H. Show that for stable equilibrium of the cone.

$$H < \frac{1}{2}\left[\frac{D^2 \cdot S^{\frac{1}{3}}}{1 - S^{\frac{1}{3}}}\right]^{\frac{1}{2}}$$

13. (a) Derive Bernoulli's equation for the flow of an incompressible frictionless fluid.

Or

(b) (i) A large tank has a rectangular sharp edged orifice 1 m broad and 0.75m deep, the top edge of which is 0.45 m below the level of water in the tank. Find the quantity of water flowing through the orifice if the coefficient of discharge is 0.62

(ii) A venturimeter is used for measuring the flow of petrol in a pipeline inclined at 35° to horizontal. The specific gravity of the petrol is 0.81 and throat area ratio is 4. If the difference in mercury level in the gauge is 50 mm. Calculate the flow in litres / hour if the pipe diameter is 0.3 m. Take discharge coefficient of the venturimeter as 0.975.

14. (a) A pipe having a length of 6km and diameter 0.7m connects two reservoirs A and B, the difference between their water levels is 30m. Halfway along the pipe there if a branch through which water can be supplied to a third reservoir C. Taking $4f = 0.024$ determine the rate of flow of reservoir B when (a) no water is discharged to reservoir C ; (b) the quantity of water discharged to reservoir C is $15 m^3/s$. Neglect minor losses.

Or

(b) A pipeline ABC 180 m long is laid on an upward slope of 1 in 60. The length of the portion AB is 90 m and it's diameter is 0.15 m. At B the pipe section is suddenly enlarges to 0.3 diameter and remains so for the remainder of it's length BC, 90m. A flow of 50 litres/s is pumped into the pipe at it's lower end A and is discharged at the upper end C into closed tank. The pressure at the supply end A is $137.34 KN/m^2$. Sketch (a) total Energy line ; (b) hydraulic gradient line and also ; (c) find the pressure at the discharged end C Take $4f = 0.02$.

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15. (a) The resistance R to the motion of a supersonic aircraft of length L moving with a velocity V, in an air of density Q depends on viscosity μ and bulk modulus K of air. Using Buckingham's π theorem obtain the expression for R.

Or

(b) (i) Write about scale effect in model analysis.

(ii) The pressure drop in an aero plane model of size 1 : 10 of it's prototype is 80N/cm^2. The model is tested in water. Find the corresponding pressure drop in the prototype. Take the density of air as 1.24 kg/m^3. The viscosity of water is 0.01 poise while the viscosity of air is 0.0018 poise.

(4 × 10 = 40 marks)