Roll No .....

AU/CE/IP/ME/PR - 405

B.E. IV Semester Examination, June 2014

Fluid Mechanics

Time : Three Hours

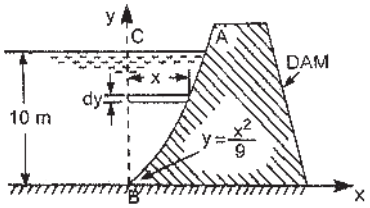
Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Differentiate between simple and inverted U-tube differential manometer. 2
   b) Define density, specific volume, weight density and specific gravity of fluid. 2
   c) 2 litre petrol weighs 14N. Calculate the specific weight, mass density, specific volume and specific gravity of petrol with respect to water. 3
   d) Determine the resistance offered to the downward sliding of a shaft of 400mm diameter and 0.1m length by the oil film between the shaft and a bearing of ID 402mm. The kinematic viscosity is $2.4\times10^{-4}m^2/s$ and density is $900kg/m^3$. The shaft is to move centrally and axially at a constant velocity of 0.1m/s. 7

   OR

   Find the magnitude and direction of the resultant water pressure acting on a curved face of a dam which is shaped according to relation $y = (x^2/9)$ as shown in fig. The height of the water retained by the dam is 10m. Consider the width of the dam as unity.



2. a) With suitable examples, differentiate between rotational and irrotational fluid flow. 2
   b) What is Magnus effect? Explain. 2
   c) Write short note on "separation of fluid flow". 3
   d) Prove that the stream function and potential function lead to orthogonality of stream lines and equipotential flow lines. 7

   OR

   Given that $u = x^2 - y^2$ and $v = -2xy$, determine the stream function and potential function for the flow.

3. a) Discuss some applications of Bernoulli's equation. 2
   b) What do we measure with weirs and notches? How? 2
   c) Explain how velocity of fluid flow is measured with the help of a Pitot tube? 3

d) A liquid with specific gravity 0.8 flows at the rate of 3 l/s through a venturimeter of diameters 6 cm and 4 cm. If the manometer fluid is mercury, determine the value of manometer reading, h. 7

OR

What is Euler's equation of motion? Derive Bernoulli's equation from Euler's equation. Discuss the assumptions made.

4. a) What is meant by geometric, kinematic and dynamic similarities? 2
   b) What are dimensionless numbers? 2
   c) What do you mean by repeating variables? How are they selected for dimensional analysis? 3
   d) The thrust force, F generated by a propeller is found to depend on the following parameters: diameter D, forward velocity u, density ρ, viscosity μ and rotational speed N. Determine the dimensionless parameters to correlate the phenomenon. 7

OR

To study the pressure drop in flow of water through a pipe, a model of scale 1/10 is used. Determine the ratio of pressure drops between model and prototype if water is used in the model. In case air is used determine the ratio of pressure drops. Take density of air as 1.2kg/m^3 and ratio of viscosity of water to air as 55.

5. a) What do you mean by 'viscous flow'? 2
   b) What is Hagen Poiseuille's formula? 2
   c) Describe Reynolds experiments to demonstrate the two types of flow. 3
   d) An oil specific gravity 0.82 and kinematic viscosity $16 \times 10^{-6} m^2/s$ flows in a smooth pipe of 8cm diameter at a rate of 21/s. Determine whether the flow is laminar or turbulent. Also calculate the velocity at the centre line and the velocity at a radius of 2.5cm. What is head loss for a length of 10m? What will be the entry length? Also determine the wall shear. 7

OR

For the laminar flow of oil with a maximum velocity of 2m/s between two horizontal parallel plates which are 10cm a part. Determine :

i) The pressure gradient

ii) The shear stress at the two horizontal parallel plates and

iii) The discharge per meter width. Given $\mu = 2.4525 Ns/m^2$.

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