CBCS SCHEME

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17MT42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Fluid Mechanics and Machines

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define fluid Mechanics and explain the types of fluids. **(08 Marks)**

b. Calculate the dynamic viscosity of oil, which issued for lubrication between a square plate of size 0.8m × 0.8m and an inclined plane with angle of inclination 30° as shown in the Fig.Q.1(b). The weight of the square plate is 300N and it slides down the inclined plane with a uniform velocity of 0.3m/sec. the thickness of oil film is 1.5mm. **(06 Marks)**

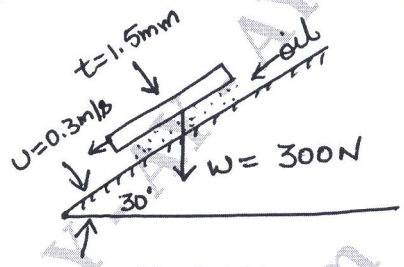

Fig.Q.1(b)

c. Define capillarity and derive an expression for capillary rise. **(06 Marks)**

OR

2 a. A differential manometer is connected at the two points A and B of two pipes as shown in the Fig.Q.2(a). The pipe A contains a liquid of specific gravity = 1.5 while pipe B contains a liquid of sp.gr = 0.9. The pressure at A and B are 1kgf/cm^2 and 1.80kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer. **(10 Marks)**

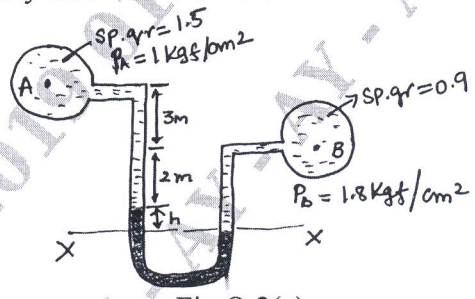

Fig.Q.2(a)

b. Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface sub merged in the liquid. **(10 Marks)**

Module-2

3 a. Define the equation of continuity, obtain an expression for continuity equation for a three dimensional flow. **(10 Marks)**

b. If for a two-dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$. Determine the velocity at the point P(4, 5). Determine also the value of stream function ψ at the point P. **(10 Marks)**

OR

4 a. What is Euler's equation of motion and derive Euler's equation of motion. **(08 Marks)**

b. With assumptions, state Bernoullis equation from Eulers equation. **(04 Marks)**

c. A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200mm diameter at a Poistion A to 500mm diameter at a position B, which is 4 metres at a higher level. If the pressures at A and B are 9.81N/cm^2 and 5.886N/cm^2, respectively and the discharge is 200lts/s. Determine the loss of head and direction of flow. [Ref.Fig.Q.4(c)] **(08 Marks)**

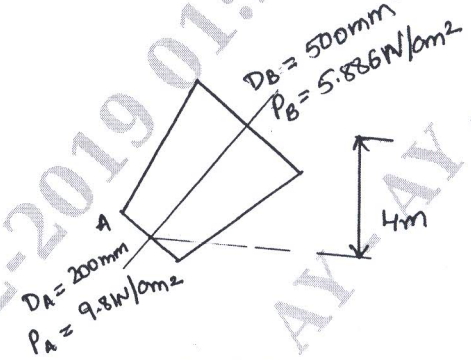

Fig.Q.4(c)

Module-3

5 a. Define Dimensional Homogenity. **(04 Marks)**

b. The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5N^2\rho\phi\left[\frac{\mu}{D^2N\rho}\right]$. Prove this by the method of dimensions (or) Buckingham (π) theorem. **(12 Marks)**

c. Define the following:
   i) Dimensionless Number
   ii) Reynold's Number
   iii) Euler's Number
   iv) Mach's Number. **(04 Marks)**

OR

6 a. What is a Venturimeter? Derive an expression for the discharge through a Venturimeter. **(10 Marks)**

b. An orifice meter with orifice diameter 15cm is inverted in a pipe of 30cm diameter. The pressure difference measured by mercury oil differential. Manometer on the two sides of the orifice meter gives a reading of 50cm of mercury. Find the rate of flow of oil of sp.gr. 0.9. When coefficient of discharge of the meter = 0.64. **(06 Marks)**

c. With a sketch, explain the Pitot tube. **(04 Marks)**

Module-4

7 a. Define turbomachine and with a neat sketch explain the parts of turbomachine. **(06 Marks)**

b. Compare a turbomachine and positive displacement machine. **(06 Marks)**

c. Derive Euler's turbine equation and state the assumptions made. **(08 Marks)**

OR

8 a. Briefly explain the nature of energy transfer and the relative value in pair terms of an alternate form of Eulers turbine equation. **(10 Marks)**

b. Explain the effect of blade discharge angel on energy transferred. **(10 Marks)**