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CH-302

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 151302

Roll No. | | | | | | | | | |

B.Tech.

(SEM. III) (ODD SEM.) THEORY EXAMINATION, 2014-15
FLUID FLOW OPERATIONS

Time : **3** Hours]   [Total Marks : **100**

Note :   (1)   Attempt all questions.

(2)   Assume missing data if any

1.   Answer any FOUR parts: 5x4=20

(a)   Sketch stress versus strain diagram for Non-Newtonian fluid.

(b)   A small diameter tube is inserted into a liquid whose contact angle is $110°$ .Will the level of liquid in the tube rise or fall? Explain

(c)   Consider two identical spherical balls submerged in water at two different depths. Will the buoyant force on the two balls is same or different. Explain.

(d)   what is the difference between gauge pressure and absolute pressure? Express Pascal's law.

(e) Consider two identical glasses of water one stationary and other moving on horizontal plane with constant acceleration. Assuming no spilling or splashing, which glass will have a higher pressure at the front, midpoint and back of bottom surface.

(f) Write any four pressure measuring devices and describe any two.

2. Answer any FOUR parts: 5x4=20

(a) A steady, two dimensional velocity field is given by

$$\vec{V} - (u, v) - (0.5 + 0.8x)\,\vec{x} + (1.5 - 0.8y)\,\vec{j}\quad \text{where}\ x$$

and y coordinates are in meters and magnitude of velocity in m/sec. Determine the stationary point.

(b) What does the word kinematic mean? Explain what you study in fluid kinematics?

(c) What is the Eulerian description of fluid motion and how does it differ from Lagrangian description?

(d) Define :Streamline, Pathline, Streakline and Timeline

(e) Describe in brief the various steps involve in Buckingham PI theorem.

(f) List and describe the three necessary conditions to complete similarity between a prototype and a model.

3. Answer any TWO parts: 10x2=20

(a) 2.16 m^3/h water at 320 K is pumped through a 40 mm I.D. pipe through a length of 150 m in a horizontal direction and up through a vertical height of 12 m. In the pipe there are fittings equivalent to 260 pipe diameters. What power must be supplied to the pump if it is 60% efficient? Take the value of fanning friction factor as 0.008. Water viscosity is 0.65 cp, and density = 1 gm/cc.

(b) Distinguish between Laminar and Turbulent flow. Define the term "relative roughness" in flow through rough pipes. What is meant by the term hydraulic mean radius?

(c) Derive the Hagen-Poiseuille equation for laminar flow through a circular pipe. State the limitations of the equation.

4. Answer any TWO parts: 10x2=20

(a) The rate of flow of water in a 150 mm diameter pipe is measured with a venturi meter of 50 mm diameter throat. When the pressure drop over the converging section is 100 mm of water, the flow rate is 2.7 kg/sec. What is the coefficient of the meter?

(b) Classify pumps. With the help of a neat sketch, explain the operation of a centrifugal pump. State the principle and applications of air lift and diaphragm pumps.

(c) Explain the principle of operation for fans, blowers and compressors. Draw diagram of various types of impellers used in mixing.

5. Answer any TWO parts: 10x2=20

(a) Explain the growth of Boundary layer for a flow over a flat plate. Indicate Laminar, Turbulent and Laminar sub layer of boundary layer.

(b) Explain boundary layer separation by giving suitable examples and different methods for preventing it. What is disadvantage of boundary layer separation?

(c) Derive differential form of continuity equation for compressible fluids. Define Mach number and explain the terms Sonic, sub sonic and supersonic.

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