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II B.Tech II Semester Examinations,December 2010 FLUID MECHANICS Chemical Engineering

Time: 3 hours

Code No: NR220803

Max Marks: 80

Answer any FIVE Questions All Questions carry equal marks *****

- 1. (a) Derive an expression of velocity distribution for turbulent flow through smooth pipes.
 - (b) A pipe line carrying water has average height of irregularities projecting from the surface of the boundary of the pipe as 0.15 mm. What type of boundary is it? The shear stress developed is $4.8N/m^2$ Take kinematic viscosity as 0.01 stokes. [8+8]
- 2. Differentiate between:-
 - (a) Absolute pressure and Atmospheric pressure
 - (b) Intensity of pressure and Total pressure
 - (c) Resultant pressure and Centre of pressure
 - (d) Positive and Negative gauge pressure. [4+4+4+4]
- 3. Derive Kozeny-Carman and Burke-plummer equation for flow through beds. [16]
- 4. (a) Explain vaccum pumps and Jet ejectors in detail.
 - (b) Compare the various devices used for moving fluids. [8+8]
- 5. (a) Define the equation of continuity. Obtain an expression for continuity equation for a three dimensional flow.
 - (b) A 30cm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2m/sec. At another section the diameter is 20cm. Find the velocity at this section and also mass rate of flow of oil. [10+6]
- 6. (a) Prove that the velocity of sound in a compressible fluid is given $by c = \sqrt{k/\rho}$ where k=Bulk modulus of fluid and ρ is density of fluid.
 - (b) A normal shock wave occurs in a duct in which air is flowing at a Mach number of 1.50. The static pressure and temperature upstream of the shock wave are 1.5 bar and 27°C. Determine the pressure, temperature and the Mach number downstream of the shock. Also calculate the strength of shock. Take k=1.4. [8+8]
- 7. (a) What are the advantages and disadvantages of centrifugal pumps?
 - (b) What is NPSH? What happens if the required NPSH is not provided? [10+6]

NR

Set No. 2

- 8. An orifice meter equipped with flange taps is to be installed to measure the flow rate of topped crude to a cracking unit. The oil is flowing at 37.8° C through a pipe of 40 m long. An adequate run of straight horizontal pipe is available for the installation. The expected maximum flow rate is $79.5m^3/h$ measured at 15.6°C. Mercury is to be used as a manometer fluid and glycol (specific gravity = 1.11) is to be used in the leads as sealing liquid. The maximum reading of the meter is to be 762mm. The viscosity of the oil at 37.8° C is 5.45×10^{-3} Kg/m.s. The specific gravity $15.6^{\circ} C$ of the oil is 0.8927. The ratio of the density of the oil at 37.8° C to that at $15.6^{\circ}C$ is 0.984. find
 - (a) the diameter of the orifice
 - (b) the power loss.

Code No: NR220803

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[10+6]

6. (a) Prove that the velocity of sound in a compressible fluid is given $by c = \sqrt{k/\rho}$ where k=Bulk modulus of fluid and ρ is density of fluid.

Code No: NR220803

NR

Set No. 4

- (b) A normal shock wave occurs in a duct in which air is flowing at a Mach number of 1.50. The static pressure and temperature upstream of the shock wave are 1.5 bar and 27°C. Determine the pressure, temperature and the Mach number downstream of the shock. Also calculate the strength of shock. Take k=1.4. [8+8]
- 7. (a) Explain vaccum pumps and Jet ejectors in detail.
 - (b) Compare the various devices used for moving fluids. [8+8]
- 8. (a) What are the advantages and disadvantages of centrifugal pumps?
 - (b) What is NPSH? What happens if the required NPSH is not provided? [10+6]

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Set No. 1

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Max Marks: 80

[10+6]

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- 2. An orifice meter equipped with flange taps is to be installed to measure the flow rate of topped crude to a cracking unit. The oil is flowing at 37.8° C through a pipe of 40 mm long. An adequate run of straight horizontal pipe is available for the installation. The expected maximum flow rate is $79.5m^3/h$ measured at 15.6° C. Mercury is to be used as a manometer fluid and glycol (specific gravity = 1.11) is to be used in the leads as sealing liquid. The maximum reading of the meter is to be 762mm. The viscosity of the oil at 37.8° C is 5.45×10^{-3} Kg/m.s. The specific gravity $15.6^{\circ}C$ of the oil is 0.8927. The ratio of the density of the oil at 37.8° C to that at $15.6^{\circ}C$ is 0.984. find
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- 6. (a) Explain vaccum pumps and Jet ejectors in detail.

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Code No: NR220803 NR Set No. 1

(b) Compare the various devices used for moving fluids. [8+8]7. Differentiate between:-(a) Absolute pressure and Atmospheric pressure (b) Intensity of pressure and Total pressure (c) Resultant pressure and Centre of pressure [4+4+4+4](d) Positive and Negative gauge pressure. 8. Derive Kozeny-Carman and Burke-plummer equation for flow through beds. [16]

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NR

Set No. 3

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