



SE-6725

B. E. III (Sem. V) (Chemical) Examination
April / May – 2011
Fluid Flow Operation

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दृष्टावेक निशानीवाणी विगतो उतरवडी पर अवश्य लपवी.
Fillup strictly the details of signs on your answer book.

Name of the Examination :
B. E. 3 (Sem. 5) (Chemical)

Name of the Subject :
Fluid Flow Operation

Subject Code No. : 6 7 2 5 Section No. (1, 2,.....): Nil

Seat No. :

Student's Signature

- (2) Figures to the right indicate full marks.
(3) Assume the data wherever necessary.
(4) Draw neat sketches wherever necessary.

1 (a) Answer the following : 2×5=10

- (i) What is potential flow and state its two important characteristics ?
(ii) Explain kinetic energy correction factor.
(iii) Define hydraulically smooth tube. What is roughness parameter ? Show it with diagram.
(iv) Define Mach number. State what is meant by subsonic, sonic and supersonic flow based on the value of mach number.
(v) Define friction factor and shape factors.

(b) Explain hydrostatic equilibrium and derive barometric equation based on it. 8

2 Answer the following : (any two) 2×8=16

- (a) Explain in detail : "Flow in boundary layer."
- (b) A pump draws a solution of sp. gravity 1.84 from a storage tank through 75 mm pipe. The velocity in the suction line is 0.914 m/s. The pump discharges through a pipe of 50 mm diameter to an overhead tank. The end of the discharge pipe is 15.2 m above the level of the solution in the tank. Frictional losses in the entire piping system are 29.9 J/kg. What is the power requirement of the pump if efficiency of the pump is 60% ?
- (c) Explain : Friction loss from sudden expansion and sudden contraction of cross section of pipe.

3 Attempt the following : (any two) 2×8=16

- (a) Derive the Kozeny-Carman equation for flow through packed bed at particles Reynold's number upto about 1.0.
- (b) It is planned to install a steel pipe with an inside diameter of 20 cm to transfer 1000 kg/min, molasses having a viscosity of 500 C.P. and a density of 1.6 gm/c.c. The line is to be 1000 meters long, and the delivery end is to be 5 meters higher than the intake : Calculate :
 - (a) The pressure drop due to friction expressed as kg/cm^2 .
 - (b) If the overall efficiency of the pump is 60%, what will be the h.p. required ?
- (c) In an air pipe line, the flow has following conditions at station 1.
Temperature = 298 K, Pressure = 1.8 bar,
Velocity = 15 m/s and pipe inside diameter = 50 mm.
At station 2 the conditions are :
Temperature = 298 K, Pressure = 1.3 bar, and pipe inside diameter = 75 mm.

Density of air at 298 K and 1.8 bar pressure is $2.1 \frac{\text{kg}}{\text{m}^3}$.

Estimate the mass flow rate of air and the velocity at station 2.

4 (a) Attempt the following : 12

- (1) Lower BWG means _____ of tube.
 - (a) Lower thickness
 - (b) Lower cross-section
 - (c) Outer diameter
 - (d) Inner diameter

- (2) How cavitation in centrifugal pump can be prevented ?
- (3) The maximum depth from which a centrifugal pump can draw water is
 (a) depend on the speed of the pump,
 (b) depend on the power of the pump,
 (c) 34 feet
 (d) 150 feet
- (4) The discharge through a V-notch weir varies as
 (a) $H^{3/2}$
 (b) $H^{1/2}$
 (c) $H^{5/2}$
- (5) Propellers are _____ mixer. (radial flow, axial flow)
- (6) Why baffles are incorporated in mixing tanks ?
- (8) Check valves are used for _____ flow.
- (9) What is function of air vessel in reciprocating pump ?
- (10) How tube is specified ?
- (11) The most economical valve for use with large diameter pipe is
 (a) butterfly valve
 (b) globe valve
 (c) needle valve
- (12) _____ is termed as variable orifice flow-meter ?
 (a) Rotameter
 (b) Pilot tube
 (c) V-notch
- (b) Discuss characteristic curves for centrifugal pump. 8
 Enlist losses occurs in centrifugal pump.

- 5** Attempt the following : (any two) **8×2=16**
- (a) An orificemeter is used to measure the flowrate of water flowing in a pipe line of 78mm ID. The orifice diameter is 15mm. Monometer reads 18 cm. The volumetric flow rate in this case is 719 cm³/s. Calculate :
 (i) The coefficient of discharge of meter,
 (ii) If the pressure drop is decreased to 9 cm of Hg, what will be the flowrate ?
- (b) Derive mathematical expression for flow through venturimeter starting with Bernoulli's theorem.

- (c) Water is to be pumped from a ground level tank, which is open to atmosphere to a cooling tower. The difference between the level of water in the tank and discharge point is 15 meters. The velocity of water through 40 mm internal diameter discharge pipe is 3 m/s. In the pipe line there is a valve which is equivalent to 200 pipe diameter and a fitting equivalent to 150 pipe diameters. The length of the entire piping is 30 meters. Calculate the power requirement of pump.

Data :

Density of water = 1000 kg/m^3 .

Viscosity of water = 0.0008 Pa. S

Friction factor ' f ' = 0.004

The pump efficiency is 60%.

- 6** Attempt the following : (any two) **7×2=14**
- (a) Discuss industrial application of fluidization.
- (b) Discuss vortex formation and vortex prevention in agitated vessel.
- (c) Write a note : Reciprocating compressor.
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