Scheme - I

Sample Question Paper

Program Name : Diploma in Chemical Engineering

Program Code : CH

Semester : Fourth

Course Title : Fluid Flow Operation

Marks : 70

$$\boxed{\textbf{22409}}$$

Time: 3 Hrs.

Instructions:

(1) All questions are compulsory.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

(5) Preferably, write the answers in sequential order.

Q.1) Attempt any FIVE of the following. **10 Marks**

   a) Give classification of fluid on the basis of density and viscosity.

   b) Define mass velocity.

   c) List out different flow meters used in the chemical industry. (Any four)

   d) Define the term equivalent length of pipe fitting.

   e) Define the term Net positive suction head (NPSH)

   f) Name any two vacuum generating equipments.

   g) Name any one incompressible fluid and give its density.

Q.2) Attempt any THREE of the following. **12 Marks**

   a) State Newton's law of viscosity and the principle of hydrostatic equilibrium.

   b) Explain the procedure for the calibration of a rotameter.

   c) Write the purpose of following fittings.

   (i) Union (ii) Plug (iii) Cross (iv) Reducer

   d) Calculate the net positive suction head (NPSH) of a centrifugal pump using the following data:

   i) Vapour pressure of the liquid = $26.66 kN/m^2$

   ii) Distance between the level of liquid in the reservoir and suction line is1.2m

   iii) Density of the liquid = $865 kg/m^3$

iv) Friction in the suction line = 3.5J/kg

v) Reservoir is open to atmosphere.

Q.3) Attempt any THREE of the following. **12 Marks**

a) Give the expression to calculate velocity distribution for flow of viscous fluid through circular pipe showing the schematic diagram of distribution from maximum to minimum value.

b) Prove that the discharge through an orifice meter is given by the relation,

$$Q = \frac{Co \; Ao \sqrt{\frac{2(P_1 - P_2)}{\rho}}}{\sqrt{(1 - \beta^4)}}$$

c) A fluid is flowing through a 5 cm diameter pipe at a velocity of 2 m/sec, that pipe is connected to a larger diameter pipe has diameter 10 cm. Calculate frictional loss due to sudden expansion.

d) Compare reciprocating compressor and centrifugal compressor on basis of following points. (i) Speed (ii) Rate of flow

Q.4) Attempt any THREE of the following. **12 Marks**

a) Estimate the pressure in N/m^2 due to a column of i) 10cm of water ii) 10cm of Hg (specific gravity of mercury is 13.6).

b) An oil of kinematic viscosity 30 stokes is flowing through a pipe 200mm diameter. If the flowrate of oil through the pipe is 25l/s determine the type of flow.

c) Draw a labeled diagram of Venturimeter and write its principle

d) Distinguish between compressor, and fan on the basis of speed, pressure developed, flow rate and efficiency.

e) Write advantage of centrifugal pump. (Any four).

Q.5) Attempt any TWO of the following. **12 Marks**

a) Water is flowing through 25 mm ID pipe at a rate of 1 kg/s. Calculate the pressure drop over a length of 100 metres.

Data – Friction factor f = 0.0001

Density of water = 1000 kg/m³.

Viscosity of water = 8.0 × 10⁻⁴Pa.s.

b) The water is flowing through a pipe having diameter 20cm and 10cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 l/s. The section 1 is 6m above

datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24N/cm^2 find the pressure intensity at section 2.

c) Describe with a neat sketch working of single acting reciprocating pump

Q.6) Attempt any TWO of the following. **12 Marks**

a) Orifice meter is installed in a pipeline for measurement of flow rate of H_2O. Pressure drop across orifice meter is 11 cm of Hg. Calculate volumetric flow rate in m^3/sec. Coefficient of orifice is 0.62.

Data: Diameter of orifice = 25 mm

Diameter of pipe = 50 mm

Density of water = 1000 kg/m^3

Density of mercury = 13600 kg/m^3

b) Sulphuric acid is to be pumped at a rate of 3kg/s through a 50mm inside diameter pipe over a straight run of 800m and is then raised vertically 15m. If the pump is electrically driven and has an efficiency of 50%, find the power required by the pump. Density of the acid = 1650kg/m^3, Viscosity of the acid = 8.6mPa.s

c) Draw a diagram of steam jet ejector and explain its working of steam jet ejector.

Scheme – I

Sample Test Paper - I

Program Name	: Diploma in Chemical Engineering	
Program Code	: CH	**22409**
Semester	: Fourth	
Course Title	: Fluid Flow Operation	
Marks	: 20	**Time: 1 Hour**

Instructions:

(1) All questions are compulsory.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

(5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR.   **08 Marks**

    a) Define fluid.

    b) Write significance of Reynolds number (any two).

    c) Distinguish between form friction and skin friction. (Any two point).

    d) State assumptions made in the derivation of Bernoulli's equation. (Any two)

    e) List out examples of Newtonian and non Newtonian fluid ((Two examples each)

    f) Write SI unit of dynamic and kinematic viscosity.

Q.2 Attempt any THREE.   **12 Marks**

    a) Calculate the friction factor when water is flowing through a 1.5cm diameter pipe at a velocity of 2cm/s. Viscosity of water $= 8.0 \times 10^{-4}$Pa.s.

    b) Draw neat sketch of Pitot tube and write its construction, working and application.

    c) Write mathematical statement of corrected form of Bernoulli's equation

    d) An oil of specific gravity 0.95 is flowing at a rate of 60 lit/sec through a pipeline of 200 mm diameter. Calculate Reynolds number (N_{Re}).

    e) Compare venturimeter and orifice meter with respect to the following points

      i) pressure recovery ii) power consumption iii) coefficient of discharge iv) pressure loss.

    f) Derive the equation $(P_1 - P_2) = h \, (\rho_m - \rho) \, g$.

Scheme - I

Sample Test Paper - II

Program Name	**: Diploma in Chemical Engineering**	
Program Code	**: CH**	**22409**
Semester	**: Fourth**	
Course Title	**: Fluid Flow Operation**	
Marks	**: 20**	**Time: 1 Hour.**

Instructions:

(1) All questions are compulsory.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

(5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR.   **08 Marks**

a) List out any four types of valve used in the chemical industry

b) Draw a sketch of any one pipe fittings and write one application of it

c) Define the term minimum fluidization velocity.

d) Define single acting pump.

e) Write pumping devices used for gases in the chemical industry.

f) Draw a neat sketch of rupture disc.

Q.2 Attempt any THREE.   **12 Marks**

a) Draw a neat label sketch of i) Gate valve ii) Globe valve

b) Calculate the net positive suction head (NPSH) of a centrifugal pump using the following data:

   i) Vapour pressure of the liquid = $26.66 kN/m^2$

   ii) Distance between the level of liquid in the reservoir and suction line is 1.2m

   iii) Density of the liquid = $865 kg/m^3$

   iv) Friction in the suction line = 3.5J/kg Reservoir is open to atmosphere.

c) List out the factors that influence the choice of pump (any four points).

d) Explain the terms i) Priming ii) cavitation.

e) Explain with a neat sketch working of steam jet ejector.

f) Differentiate between piping and tubing. (Any two point)