22409

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

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

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **5 × 2 = 10**

(a) Define Ideal and Real fluids.

(b) Define critical velocity of fluid; also give formula to calculate it.

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

(d) Name the suitable pipe fitting to be used in following situation :

(i) Branching of pipe

(ii) Connecting pipes of different diameters

(iii) Changing direction of flow

(iv) Termination of pipeline

(e) Define the term Net Positive Suction Head (NPSH).

(f) Name any two equipments used for transportation of gases in industry.

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

2. Attempt any THREE of the following : **3 × 4 = 12**

(a) Define Newtonian and non-Newtonian fluid. Draw the graph showing relationship between shear stress and shear rate for different types of Newtonian and non-Newtonian fluid.

(b) Explain the procedure for the calibration of Orificemeter.

(c) Write the application of following valves :

(i) Needle Valve (ii) Check Valve

(iii) Gate valve (iv) Diaphragm Valve

(d) Calculate NPSH of the pump from the following data :

(i) Vapour pressure of liquid = 200 mm of Hg.

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

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

(iv) Friction in the suction line = 3.43 J/kg.

(v) Reservoir is open to atmosphere.

3. Attempt any THREE of the following : **3 × 4 = 12**

(a) Derive Hagen-Poiseuille equation.

(b) Applying Bernoulli's equation derive the equation for discharge through a venturimeter.

(c) A pipe of 15 cm diameter carries flow of fluid with a velocity of 8.5 m/s is enlarged to 30 cm diameter. Calculate the frictional loss due to sudden enlargement.

(d) Give industrial applications of blower and compressor.

4. Attempt any THREE of the following : **3 × 4 = 12**

(a) A closed tank contains 0.5 m Hg and 1.5 m water, 2 m of oil of specific gravity 0.8 and air space above the oil, if the pressure at the bottom of tank is 30 N/cm^2 gauge. Calculate the reading of the gauge at the top of the tank.

(b) Water is flowing through a pipe of diameter 30 cm at a velocity of 4 m/s. Find the velocity of oil flowing in another pipe of diameter 10 cm, if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.01 poise and 0.025 poise. The specific gravity of oil is 0.8.

(c) Explain construction of Pitot tube with neat labelled diagram.

(d) Explain construction and working of rupture disc.

(e) Differentiate a reciprocating pump and a centrifugal pump on the following points :

(i) Pressure developed

(ii) Discharge type

(iii) Efficiency

(iv) Priming

5. Attempt any TWO of the following : **2 × 6 = 12**

(a) A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 liters per sec. Find the head lost due to friction for a length of 50 m of the pipe.

(b) A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position A to a 500 mm diameter at a position B which is 4 m at higher level. If the pressure at A is 9.81 N / cm^2 and the discharge is 200 liters /s. determine the pressure intensity at position B.

(c) Describe with neat diagram, construction and working of a gear pump.

6. Attempt any TWO of the following : **2 × 6 = 12**

(a) A venturimeter is inserted in vertical pipe of diameter 20 cm carrying oil of sp. gr. 0.8, the flow of oil is in upward direction. The pressure drop across the throat and upstream of the meter is 30 cm of mercury. The diameter of throat is 10 cm. Calculate the volumetric flow rate of oil in m^3/sec. Take $C_d = 0.98$ and sp. gr. of mercury = 13.6

(b) Fluid of density 1900 kg/m^3 and viscosity 0.07 poise is to be pumped for a length of 800 m through a 70 mm inner dia pipe at the rate of 2.5 kg/sec and then raised vertically to a height of 25 m by a pump. If the pump efficiency is 60%, what power will be required in watts ?

(c) Describe with neat diagram, construction and working of steam jet ejector.
