24225

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

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.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

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

(a) Define following terms :

(i) Pressure gradient (ii) Viscosity

(b) Give significance of Reynold's number.

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

(d) Differentiate between pipe and tubing. (2 points)

(e) Give any two applications of diaphragm pump.

(f) Define minimum fluidisation velocity.

(g) Define Ideal and Real fluid.

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) Draw a labelled diagram of venturimeter and explain its working.

(c) State the purpose of following fitting :

(i) Tee

(ii) Cross

(iii) Plug

(iv) Bend

(d) Draw diagram of gear pump and write its construction.

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

(a) Toluene is flowing at a rate of 12 lit/sec through a 3 cm diameter pipe. Density of toluene is 870 kg/m^3. Calculate :

(i) Volumetric flowrate m^3/s

(ii) Mass flow rate kg/s

(iii) Average velocity m/s

(iv) Mass velocity kg / ($m^2 \cdot s$)

(b) Differentiate between venturimeter and orifice meter. (4 points)

(c) Explain construction and working of Rupture Disc with diagram.

(d) Give industrial applications of blower and compressor. (2 each)

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

(a) A simple U tube manometer is installed across a pipeline. The manometer fluid is mercury (sp. gravity 13.6) and flowing fluid is CC*l*4 (sp. gravity 1.6) Manometer reads 175 mm. What is the pressure difference over the manometer in N/m^2 ?

(b) Derive Hagen-Poiseuille equation.

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

(d) State the principle of induced draft and forced draft fan.

(e) Explain the following terms :

(i) Cavitation

(ii) NPSH

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

(a) Fluid is to be pumped at a rate of 1.5 m^3/min through a 50 mm id, 100 m long pipe. Density of the fluid is 1050 kg/m^3 and kinematic viscosity of the fluid is 2.35×10^{-6} m^2/s. What is the pressure drop in the pipe ?

(b) Orifice meter is installed in a pipe line for measurement of flow rate of water. Pressure drop across orifice meter is 12 cm of Hg. Calculate volumetric flow rate in m^3/sec.

Co-efficient of orifice = 0.62

Diameter of orifice = 25 mm

Diameter of pipe = 50 mm

Density of mercury = 13600 kg/m^3

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

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

(a) Derive the Bernoulli's equation.

(b) Water is to be pumped at a rate of 8 m^3/hr from a large reservoir resting on the floor to the open top of an experimental absorption tower through a 50 mm internal diameter pipe. The point of discharge is 5 m above the floor and frictional losses in the entire flow system amount to 2.5 J/kg. At what height in the reservoir the water be kept if the pump can develop a power of 94 W ? Assume efficiency of pump as 60%.

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