21819

3 Hours / 100 Marks Seat No. | | | | | | | | |

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

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

(3) Assume suitable data, if necessary.

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

Marks

1. (A) Attempt any SIX of the following : **12**

(a) Define viscosity. Write its SI unit.

(b) Give one example of incompressible and compressible fluid.

(c) State the significance of Reynolds number.

(d) Suggest suitable pipe fitting in following case :

(i) Termination of pipe

(ii) Frequent removal of section pipe in a pipe line.

(e) What is meant by hydraulically smooth pipe ?

(f) What is air binding ? How it can be avoided ?

(g) Write the range of pressure developed by

(i) Fan

(ii) Centrifugal blower

(B) Answer any TWO of the following : **8**

(i) Derive an expression of continuity in case of incompressible fluid.

(ii) Draw the neat labelled sketch of globe valve.

(iii) Explain cavitation. How it can be avoided ?

2. Attempt any FOUR of the following : **16**

(a) For a U tube manometer, derive an expression for calculating pressure.

(b) For a laminar flow of fluid through 4 cm diameter pipe, the maximum velocity is 4 cm/s. Find the velocity at a distance of 1 cm from a centre towards wall.

(c) Draw the characteristics curves for centrifugal pump. Show duty point. State importance of characteristics curves.

(d) Distinguish between safety valve and rupture disc. Draw labelled sketch showing an arrangement of rupture disc used.

(e) For laminar flow of fluid through a pipe prove that $f = \frac{16}{N_{R_e}}$. Explain the meaning of each term involved.

(f) Explain the procedure for calibrating rotameter in a lab.

3. Attempt any FOUR of the following : **16**

(a) An open tank contains water upto depth of 1.5 m and above it an oil of specific gravity 0.8 for a depth of 2 m. Find the pressure exerted at the bottom.

(b) Describe the classification of valve. Suggest suitable valves for following situation :

(i) Accurate control of extremely smaller flow rate.

(ii) Flow regulation of corrosive fluids.

(c) Draw neat labelled sketch of double acting reciprocating pump.

(d) Why reciprocating compressor requires interstage cooling ?

(e) State Newton's law of viscosity. Write mathematical expression and explain meaning of each term involved in it.

(f) Calculate the NPSH of pump using following data :

(i) Vapour pressure = 40 kN/m^2

(ii) Distance between suction line and level of liquid in reservoir = 1.5 m

(iii) Density of liquid = 840 kg/m^3

(iv) Frictional loss in the suction line = 3.5 J/kg

(v) Reservoir is open to atmosphere

4. Answer any FOUR of the following : 16

(a) Differentiate between tube and pipe on the basis of :

(i) Length (ii) Method of expressing thickness

(iii) MOC (iv) Method of fitting

(b) Describe Reynold's experiment.

(c) Draw the neat labelled sketch of steam jet ejector. State its application.

(d) Differentiate between variable head flowmeter and variable area flowmeter on the basis of

(i) working principle (ii) method of mounting

(iii) method of estimating flow rate (iv) example of each

(e) Flow rate of fluid through 8 cm pipe is 1 m^3/hr. If diameter of pipe is suddenly reduced to 5 cm. Find head loss due to sudden contraction.

(f) 12 *l*/min of toluene is flowing through a pipe of 1.5 cm ID pipe. If density of toluene is 0.9 g/cm^3. Calculate

(i) volumetric flow rate in m^3/s

(ii) mass flow rate in g/s

5. Answer any TWO of the following : **16**

(a) A sugar syrup is flowing in a pipe line of 75 mm ID at a flow rate of 3 *l*/min. which has viscosity of 1.5 poise and density 1.1 g/cm^3. Calculate the pressure drop and friction loss over a length of 50 m.

(b) What is hydrostatic equilibrium ? Using this concept, prove that pressure exerted by height of liquid column, can be estimated by $P = h\rho g$.

(c) Mass flow rate of water through 50 mm ID pipe is 90 kg/min. If orifice diameter is 25 mm and co-efficient of discharge of orifice meter is 0.62, what will be reading in a mercury manometer connected across orifice meter ?

Data : $\rho_{H_2O} = 1000$ kg/m^3, $\rho_m = 13600$ kg/m^3

6. Answer any TWO of the following : **16**

(a) Derive Bernoulli's equation for flow of fluid through a pipe. Write the assumptions made.

(b) With neat labelled sketch, explain principle, construction and working of centrifugal pump.

(c) Write the specific application of fluid transportation devices mentioned below :

(i) Centrifugal compressor

(ii) Centrifugal blower

(iii) Reciprocating compressor

(iv) Fan

Justify why size of the impeller required in case of centrifugal blower is large.
