17426

**15162**

**3 Hours / 100 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.

**Marks**

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

(a) Define dynamic viscosity, write its unit in CGS system.

(b) Write any two examples of Non-Newtonian fluids.

(c) Define critical velocity of fluid, write it's formula to calculate it.

(d) Define fanning friction factor.

(e) Suggest the name of fitting used for

(i) Changing the size of pipeline

(ii) Branching of the pipeline

(f) Write the application of Diaphragm pump.

(g) Write the maximum pressure developed by reciprocating, centrifugal compressors.

**(B) Attempt any TWO of the following :** **08**

(a) State, derive equation of continuity.

(b) Draw a neat labelled diagram of a gate valve.

(c) Explain the working of a centrifugal pump.

**P.T.O.**

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

(a) Draw the diagram of U-tube manometer used for measurement of differential pressure and write it's expression to calculate the pressure drop.

(b) List the types of friction & define each type.

(c) Write the working mechanism of a rupture disc and also write it's applications.

(d) Explain the term 'Priming of a pump'.

(e) Write the expressions of fanning friction factor for Laminar, Turbulent flow.

(f) Draw a neat sketch of Rotameter.

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

(a) Derive an expression of pressure drop by using a well type manometer.

(b) Write the uses of valves and also give any six examples of valves used in chemical industries.

(c) Write down the classification of pumps.

(d) Draw a neat diagram of a steam jet ejector.

(e) State, derive Newton's law of viscosity.

(f) Draw, explain characteristics curves of a centrifugal pump.

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

(a) Draw the diagram of a plug, bend and state their applications.

(b) Explain the types of flows and specify them on the basis of Reynolds number.

(c) Write the specific applications of fans, blowers, compressors.

(d) Explain the construction of a Venturimeter with a suitable diagram.

(e) Calculate the pressure drop due to friction in a 300 m long pipe of 150 mm I.D. through which water is flowing at a rate of 0.05 $m^3/s$.

Data : Density of water = 1000 $kg/m^3$

Viscosity of water = $1 \times 10^{-3}$ $N\text{-}s/m^2$

(f) The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.

Data : $\rho_{Hg}$ = 13,600 $kg/m^3$, $\rho_{H_2O}$ = 1000 $kg/m^3$

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

(a) Derive an expression of Hagen Poiseuille's equation.

(b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm, 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm diameter pipe, if the average velocity in the 20 cm diameter pipe is 2 m/s.

(c) An orificemeter is used to measure the flow rate of water flowing in a pipeline of 78 mm I.D. The orifice diameter is 15 mm. Mercury manometer reads 18 cm. The volumetric flow rate in this case is 719 $cm^3/s$.

(i) Calculate the coefficient of discharge of the meter.

(ii) If the pressure drop is decreased to 9 cm of mercury, what will be the flow rate ?

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

(a) Describe the construction of a single acting reciprocating pump with a suitable diagram.

(b) Derive Bernoulli's equation and explain each term in it.

(c) Describe the construction and working of vacuum pump with a neat diagram.

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