



Name :

Roll No. :

Invigilator's Signature :

CS/B. Tech (CT-N)/SEM-3/CHE (CT)-301/2011-12

2011

UNIT OPERATION-I

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

$$10 \times 1 = 10$$

- i) Reynolds No. in viscous flow is

- a) less than 2100
- b) greater than 2100
- c) more than 2100 and less than 4000
- d) greater than 4000.

- ii) Which of the following permits flow in one direction only

- a) gate valve
- b) check valve
- c) needle valve
- d) globe valve.



iii) Expression for logarithmic mean radius is

- a) $(r_0 - r_i) / \ln r_0 r_i$ b) $(r_0 + r_i) / \ln r_0 r_i$
c) $(r_0 + r_i) / \ln r_0 / r_i$ d) $(r_0 - r_i) / \ln r_0 / r_i$.

iv) The plot of shear stress vs. velocity gradient at constant temperature and pressure is a straight line with positive intercept on shear stress axis. Such a fluid is called

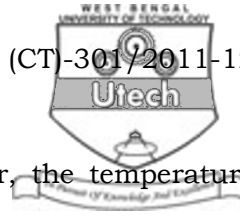
- a) Newtonian fluid b) Bingham plastic
c) Pseudo plastic fluid d) dilatant fluid.

v) Diaphragm pump is used for handling

- a) low pressure
b) high pressure
c) toxic or corrosive liquid
d) none of these.

vi) Permanent head loss in a venturimeter is

- a) 0
b) 90% of venturi differential
c) 10% of venturi differential
d) none of these.



vii) In case of steady state heat transfer, the temperature profile is

- a) parabolic b) hyperbolic
- c) exponential d) none of these.

viii) In a Shell and Tube heat exchanger, baffles are provided on the shell side

- a) to increase heat transfer area
- b) to induce turbulence in the shell side liquid, thereby increasing the shell side heat transfer coefficient
- c) to give structural support to the tubes
- d) all of the above.

ix) Parallel flow heat exchange becomes equally efficient compared to a counter flow heat exchanger when

- a) cold fluid is molten metal
- b) hot fluid inlet temperature is above 300°C
- c) one of the fluid undergoes isothermal phase change.



- x) The overall heat transfer coefficient, when two moving fluids are separated by a metal wall, largely depends upon the layer
- a) which offers least resistance to heat flow
 - b) which offers most resistance to heat flow
 - c) composed of metal wall
 - d) which has the least thickness.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Why a rotameter is called an areameter ? Prove that the drag force on the float always remains constant for a set of meter and fluid. 1 + 4
3. With the help of a neat sketch describe the principle of a differential manometer. 5
4. Draw the diagram of a centrifugal pump and level different parts of it. 5
5. Derive the expression for log mean temperature difference for the entire area of a heat exchanger. 5
6. What is hydraulic radius ? How would you calculate the equivalent diameter of annual cross section ? 2 + 3



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) An oil is pumped 1.5 Km from an industrial unit to a storage tank through a mild steel pipe line, 140 mm diameter, at the rate of $0.05 \text{ m}^3/\text{s}$. What is the pressure drop along the pipe and the power supplied to the pumping unit if it has an efficiency of 60% ?

Data : Sp.gr. of the oil = 0.705

viscosity of the liquid = 0.5 mNs/m^2

friction factor = 3.3×10^{-3} .

- b) A liquid of specific gravity 1.86 and viscosity $65 \times 10^{-2} \text{ gr/cm.sec}$ is flowing through a channel (4 cm \times 4 cm) at an average velocity of 4.5 m/s. What is the Reynolds number ? $10 + 5$



8. Describe the construction and principle of a Venturimeter.

Discuss the comparative advantages and disadvantages of orificemeter and venturimeter. What do you mean by nominal diameter and schedule no.

8 + 4 + 3

9. A concentric tube heat exchanger is required to cool 20 kg/s of water from 360K to 340K by means of 25 kg/s water entering at 300K. The overall coefficient of heat transfer is kept constant at $2 \text{ KW/m}^2\text{K}$. Calculate the surface area required in

a) Countercurrent

b) Co-current flow conditions

15

10. a) Derive an expression for overall heat transfer co-efficient based on outside area of a pipe incorporating the effects of metal wall, scale and dirt factors.

b) Define a black body. What do you mean by total radiating power. State Kirchoffs Law of radiation.

8 + 2 + 3 + 2



11. Write short notes on any *three* of the following : 3×5

- a) Net Positive Suction Head and Cavitation
- b) Gear pump
- c) Drag Coefficient
- d) Compound resistance in series in heat conduction
- e) Incorporation of Kinetic energy correction factor and frictional loss.

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