

Roll No. & Sign:



A Charutar Vidya Mandal's Institution
V.P. & R.P.T.P. SCIENCE COLLEGE
(AUTONOMOUS) (Grant – in – Aid)
Affiliated to Sardar Patel University



Bachelor of Science (Semester – 4) Internal Theory Examination – 2026
US04MAICV01: Fluid Flow and Heat Transfer Operations

Date: 7th March, 2026

Time: 02:45 PM to 04:15 PM

Day: Saturday

Total Marks: 30 Marks

Q – 1 Answer the following Multiple-Choice Questions. (All are compulsory)

[06]

- Reynolds number less than 2000 indicates:
(A) Turbulent flow (B) Laminar flow
(C) Transition flow (D) Compressible flow
- Which pump is suitable for high head and low discharge?
(A) Centrifugal pump (B) Reciprocating pump
(C) Gear pump (D) Jet pump
- Fourier's law of heat conduction states that heat flow is proportional to:
(A) Temperature (B) Temperature difference
(C) Temperature gradient (D) Thermal resistance
- Fins are provided in heat exchangers to:
(A) Reduce pressure drop (B) Decrease temperature
(C) Increase surface area (D) Increase fluid velocity
- In a shell and tube heat exchanger, baffles are used to:
(A) Reduce heat transfer (B) Increase shell-side turbulence
(C) Block flow (D) Reduce surface area
- In a distillation column, the top product is called:
(A) Bottoms (B) Residue
(C) Distillate (D) Slurry



Q – 2 Define viscosity. Differentiate between Newtonian and Non-Newtonian fluids with examples.

[06]

OR

Q – 2 Explain Bernoulli's theorem, its assumptions, and its applications. Also derive the equation for it.

[06]

Q – 3 Derive the equation for heat flow through a cylinder under steady-state conditions.

OR

Q – 3 A furnace is constructed with 200 mm of fire brick, 100 mm of insulating brick and 200 mm of building brick. The inside temperature is 650 °C and the outside temperature is 165 °C. Find the heat loss per unit area and the temperature at the junction of the fire brick and the insulating brick.

[06]

[06]

Data:	Type of brick	'k' kcal/hr m °C
	Fire brick	5.2
	Insulating brick	0.5
	Building brick	2.0

Q – 4 Describe the construction and working of double-pipe heat exchangers and discuss their advantages and limitations. [06]

OR

Q – 4 Explain the working principle of Plate-type heat exchanger with a neat sketch. [06]

Q – 5 List different steps which should be followed while solving material balance problems.

OR

Q – 5 An evaporator is fed with 15000 kg/h of a solution containing 10% NaCl, 15% NaOH and rest water. In operation water is evaporated and NaCl is precipitated as crystals. The thick liquor leaving the evaporator contains 45% NaOH, 2% NaCl and rest water. Calculate: [06]

(a) kg/h water evaporated (b) kg/h salt precipitated (c) kg/h thick liquor obtained [06]



Supervisor Signature:

QUIZ TEST

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Date: 7th March, 2026

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Obtain Marks:

Day: Saturday

Total Marks: 15 Marks

Examiner Signature:

Note: The figure to the right indicates full marks of the questions.

Q-1 Fill in the blanks with the appropriate answer given in the bracket [8 Marks]

1. The continuity equation is based on _____ law. (Newton's second /conservation of mass).
2. Reynolds Number less than 2000 indicates _____ flow. (Laminar/Turbulent)
3. Thermal conductivity of metals is generally _____. (Low/High)
4. In forced convection, fluid motion is caused by _____.
(Density difference/External means like pump or fan)
5. Log Mean Temperature Difference (LMTD) is used in _____.
(Radiation problems / Heat exchanger analysis)
6. Plate heat exchangers are best suited for _____.
(Compact heat transfer applications / Solid materials)
7. For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$, the stoichiometric ratio of H_2 : N_2 is _____.
(3:1/1:3)
8. In Distillation, top product is called _____. (Residue/Distillate)



Q-2 State whether the following statement is true or false. [Write answer in the box] [7 Marks]

1. Toothpaste is an example of Pseudo plastic non-Newtonian fluid.
2. The unit of overall heat transfer coefficient (U) is $W/(m^2.K)$
3. For better heat transfer performance, counter flow arrangement is preferred.
4. The steady state condition means Temperature changes with time.
5. A kettle type reboiler is mainly used in distillation column.
6. Limiting reactant is in less amount than stoichiometric requirement.
7. % conversion is given based on excess reactant.