This question paper contains **2** printed pages]

NA—218—2023

FACULTY OF SCIENCE

B.Sc. (Second Semester) EXAMINATION

NOVEMBER/DECEMBER, 2023

(New Pattern)

INDUSTRIAL CHEMISTRY

Paper-IV

(Energy Balance and Process Calculation)

(Wednesday, 27-12-2023) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :— (1) Solve *all* questions.

(2) Scientific calculator is allowed.

1. Explain heat capacity. Derive the equation $C_p - C_v = R$. 15

Or

Methane gas is heated from 303 K (30°C) to 523 K (250°C) at atmospheric pressure. Calculate the heat added per kmol methane using C_p° data given below :

Data $C_p^\circ = a + bT + cT^2 + dT^3$ kJ/C kmol–K :

Gas	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
Methane	19.2494	52.1135	11.973	–11.3173

2. A dryer is used to dry 100 kg/h wet solids from 20% to 1% moisture by weight by hot air. The fresh air containing 0.02 kg water vapour per kg dry air is

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available at 303 K (30°C) and 101.325 kPa. Air leaving the dryer is found to contain 0.1 kg water vapour per kg dry air. If the recycle ratio is maintained at 3 kg dry air in a recycle air per kg dry air in a fresh air, calculate the volumetric flow rate of fresh air assuming the molecular weight of fresh air to be 28.8. 15

Or

(*a*) Explain in detail ultimate analysis coal. 8

(*b*) Write a note on chemical oxygen demand. 7

3. Write short notes on (any *two*) : 10

(*a*) Acidity and Alkalinity

(*b*) Purging ratio

(*c*) Heat and work

(*d*) Recycle ratio.