NA—128—2023

FACULTY OF SCIENCE

B.Sc. (First Year) (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2023

(New Course)

INDUSTRIAL CHEMISTRY

Paper I

(Fluid Mechanics and Unit Operation)

(Friday, 22-12-2023)   **Time : 10.00 a.m. to 12.00 noon**

Time—Two Hours   *Maximum Marks—40*

N.B. :— (*i*)   Use of log table and scientific calculator is allowed.

  (*ii*)   Solve *all* the questions.

1.   Explain construction and working of U-Tube manometer and inclined manometer with neat labelled diagram.   15

Or

Solve the problems :

(*a*)   An orifice meter equipped with flange taps is to be installed to measure the flow rate of topped crude to a cracking unit. The oil is flowing through a 100 mm i.d. pipe and an adequate run of the straight horizontal pipe is available for the installation of the meter. The expected maximum

P.T.O.

flow rate is 79.5 m^3/h. Mercury is to be used as manometer fluid and glycol is to be used in the leads as a sealing liquid. The maximum reading of the meter is 762 mm. Calculate :

(*i*) The diameter of the orifice and

(*ii*) The power loss if 68% of the orifice differential is permanently lost.

Data :

sp gr of oil = 0.89

sp gr of glycol = 1.11

sp gr of mercury = 13.6

ρ of water 1000 kg/m^3

coefficient of meter = 0.61.   8

(*b*) Water at 294 K (21ºC) is flowing at velocity of 3 m/s through the annulus between a tube with an outside diameter of 25 mm another with an internal diameter of 50 mm in a concentric tube heat exchanger. Estimate the pressure drop due to friction per 1 m length of annulas.   7

2. Explain Bernoulli equation with neat labelled diagram and give mathematical expression for it.   15

Or

Solve the problem :

(*a*)   Sulphuric acid is pumped at 3 kg/s through a pipeline of 25 mm diameter and 60 m length. Calculate the drop in pressure. If the pressure drop falls by one half, what will be the new flow rate ?   8

(*b*)   Water at 303 K (30ºC) flows through a horizontal pipe 25 mm in diameter in which the pressure drop per metre length is to be limited to 2.35 pa/m. Calculate the volumetric flow rate.   7

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

(*a*)   Laminar and turbulant flow

(*b*)   Equation of continuity

(*c*)   Average velocity

(*d*)   Compressible fluid.