

Roll No

CM-801(A) (GS)
B.E. VIII Semester Examination, June 2020
Grading System (GS)
Process Piping Design
(Elective - III)
Time : Three Hours

Maximum Marks : 70

- Note:** i) Attempt any five questions.
ii) All questions carry equal marks.

1. Determine the minimum wall thickness t_m in (mm) and schedule number SN for a branch steam pipe operating at 900°F (482.2°C) if the internal steam pressure is 1000 lb/in^2 (abs) (6894 kPa).
2. Explain minor losses when the path of the fluid is suddenly changed in course of its flow through a closed duct to any abrupt change in the geometry of the duct.
3. Two pipes each 300 mm long are available for connecting to a reservoir from which a flow of $0.081 \text{ m}^3/\text{s}$ is required. If the diameter of the two pipes are 0.30 m and 0.15 m respectively. Determine the ratio of the head loss when the pipes are connected in series to the head loss when they are connected in parallel. Neglect minor losses.

OR

- What do you mean by Reynolds and apparent Reynolds number. Discuss the Reynolds transport theorem in detail.
4. Ninety-eight percent sulphuric acid is pumped at 4.5 tonne/h through a 25 mm diameter pipe, 30m long, to a reservoir 12m higher than the feed point.
Calculate the pressure drop in the pipeline.
Viscosity of acid = 25 mNs/m^2
Density of acid = 1840 kg/m^3
Friction factor $f = 0.006$
 5. With the help of neat sketches describe a mixed flow pattern(neither separated nor dispersed) for:
i) gas-liquid flow.
ii) liquid-liquid flow.
 6. Ethanol at 20°C flows at 125 U.S. gal/min through a horizontal cast-iron pipe with $L = 12 \text{ m}$ and $d = 5 \text{ cm}$. Neglecting entrance effects, estimate (a) the pressure gradient, dp/dx ; (b) the wall shear stress, TW ; and (c) the percent reduction in friction factor if the pipe walls are polished to a smooth surface.
For ethanol take $r = 789 \text{ kg/m}^3$ and $m = 0.0012 \text{ kg/m}^2\text{s}$.

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7. Using relevant flow pattern maps (Baker et al for horizontal tube and Hewitt and Roberts for vertical tube) evaluate the most likely flow pattern occurring for a steam-water system flowing in a 2.54cm diameter (vertical (b) horizontal pipe where the system pressure is 70 Bar, the mass qualities are 1% and 50% and the mass fluxes are:
- i) 500 kg/m² - sec and
 - ii) 2000kg/m² - sec respectively.
8. Write a short notes on : (any two)
- a) Power-law fluids
 - b) Deborah number
 - c) Rabinowitsch-Mooney Relation.
