

II B. Tech I Semester Supplementary Examinations, September - 2021
FLUID MECHANICS
 (Civil Engineering)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
 All Questions carry **Equal** Marks

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- 1 a) A certain liquid has dynamic viscosity of 0.073 poise and specific gravity of 0.87. [6M]
 Compute the kinematic viscosity of the liquid in stokes and also in m^2/s .
- b) The left limb of a single U-tube manometer containing mercury is connected to a [9M]
 pipe in which a fluid of specific gravity 0.8 is flowing at a pressure below
 atmospheric pressure. The other end of the manometer is open to the atmosphere.
 Find the vacuum pressure in the pipe, if the level of mercury in the left limb of the
 manometer is 5cm above the level in the right limb and 30cm below the centre of
 the pipe.
- Or
- 2 a) Explain with sketch how an inverted U-tube manometer is used to measure small [6M]
 pressure differences.
- b) A rectangular gate 5m x 3m is placed under water such that the 3m edges are [9M]
 parallel to the free surface. The top and bottom edges are 4m and 8m below the
 water surface respectively. Determine the total pressure and the position of the
 centre of pressure on the gate.
- 3 a) Describe the use and limitations of flow-nets. [6M]
- b) A 30cm diameter pipe conveying water, branches into two pipes of diameter 20cm [9M]
 and 15cm respectively. If the average velocity in the 30cm diameter pipe is 2.5m/s,
 find the total discharge in this pipe. Also determine the velocity in the 15cm pipe if
 the average velocity in the 20cm diameter pipe is 2m/s.
- Or
- 4 a) Find whether the velocity potential function, $\phi = -4xy$ describes a case of [6M]
 incompressible flow.
- b) A pipe line 30cm in diameter is gradually reduced to 20cm diameter in a length of [9M]
 30cm and connects to a 20cm diameter pipe line. If the discharge is $0.15m^3/s$ and
 the pressure before the contraction is 180kPa, i) find the pressure after the
 contraction, ii) calculate the force exerted by the flow on the contraction.
- 5 a) Sketch Moody's diagram and show the variation of friction factor, f with [6M]
 Reynold's number in laminar range.
- b) A pipe of diameter 20cm and length 2000m connects two reservoirs having the [9M]
 difference of water levels as 20m. If an additional pipe 20cm and length 1200m is
 attached parallel to the last 1200m length of the existing pipe, find the increase in
 discharge. Take the friction factor as 0.04. Neglect minor losses.
- Or
- 6 a) Show that the loss of head due to sudden expansion in a pipeline is a function of [6M]
 velocity head.
- b) Derive the Hagen-Poiseuille equation for head loss due to friction in laminar flow [9M]
 through a circular pipe.



- 7 a) Make a comparison of a venturimeter and an orifice meter in the measurement of discharge through a pipe. [6M]
b) A tank 2m x 2m and another 1m x 1m are connected at the bottom by a circular orifice of diameter 2cm. If initially the larger tank has water 0.5m above the smaller tank, calculate the time required to reduce the level difference to 0.2m. Assume coefficient of discharge, $C_d=0.62$. [9M]
- Or
- 8 a) Explain the classification of orifices and mouth pieces based on their shape, size and sharpness. [6M]
b) An orifice meter with orifice diameter 15cm is inserted in a pipe of 25cm diameter. The pressure gauges fitted upstream and downstream of the orifice gave readings of 19.82N/cm^2 and 9.86N/cm^2 respectively. The overall coefficient for the meter is given as 0.6. Find the discharge of water through the pipe. [9M]
- 9 a) Explain the development of boundary layer, over a flat plate. [6M]
b) A flat plate 0.5m wide and 3m long is placed in an air stream of 12m/s, with the 3m side parallel to the flow. Find i) what is the maximum thickness of a laminar boundary layer, ii) what is the thickness of the boundary layer at 0.04m from the leading edge, iii) what is the shear stress at the boundary layer at 0.04m from the leading edge? Take density= 1.2kg/m^3 and kinematic viscosity= $15 \times 10^{-6}\text{m}^2/\text{s}$. [9M]
- Or
- 10 a) What are the different methods of preventing the separation of boundary layers? [6M]
b) Oil with a stream velocity of 6m/s flows over a thin plate 2.5m wide and 2.5m long. Calculate the boundary layer thickness and shear stress at the trailing edge. Determine the total drag on the plate. Assume specific gravity, $S=0.84$ and kinematic viscosity, $\nu=10^{-5}\text{m}^2/\text{s}$. [9M]

