Code No: R2021013 **R20** SET - 1

II B. Tech I Semester Supplementary Examinations, July - 2022
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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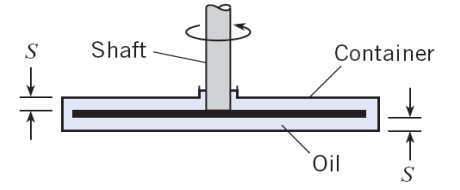
1 a) The information on a can of pop indicates that the can contains 355 mL. The mass of a full can of pop is 0.369 kg while an empty can weighs 0.153 N. Determine the specific weight, density, and specific gravity of the pop. [7M]

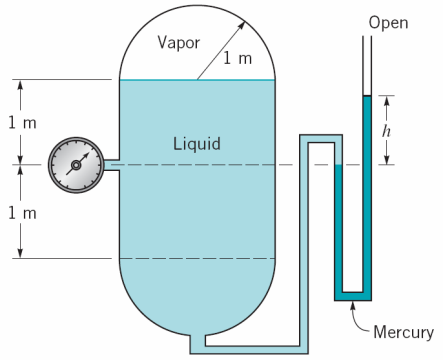
b) What are Newtonian and non-Newtonian fluids? Explain using examples. [7M]

Or

2 a) Some instrument having angular motion is damped by means of a disk connected to the shaft. The disk, in turn, is immersed in a container of oil as shown in the figure. Derive a formula for the damping torque as a function of disk diameter D, spacing S, rate of rotation ω, and oil viscosity μ. [7M]



b) The cylindrical tank with hemispherical ends shown in Fig 1 contains a volatile liquid and its vapour. The liquid density is 800 kg/m3, and its vapour density is negligible. The pressure in the vapour is 120 kPa (abs), and the atmospheric pressure is 101 kPa (abs). Determine: (a) The gauge pressure reading on the pressure gauge, and (b) The height, h, of the mercury manometer. [7M]



3 a) Discuss the following terms: [7M]
i) Stream Line ii) Path Line iii) Streak Line

b) Derive Euler's equation of motion for a flowing fluid. [7M]

Or

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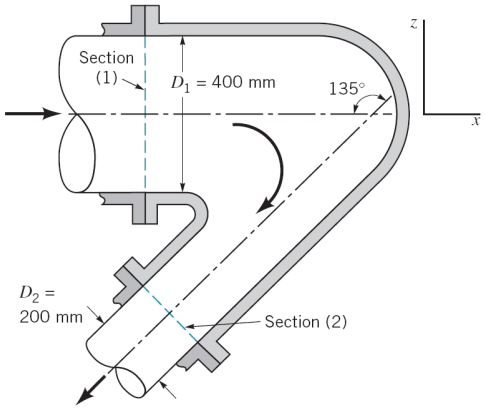
4 a) The stream function for an incompressible, two dimensional flow field is $\psi = ay - by^3$ where *a* and *b* are constants. Is this an Irrotational flow? [7M]

b) A converging elbow turns water through an angle of 135° in a vertical plane as shown in Fig. The elbow flow passage volume is 0.2 m^3 between sections (1) and (2). The water volume flow rate is 0.4m^3/s and the elbow inlet and outlet pressures are 150kPa and 90kPa. The elbow mass is 12kg. Calculate the horizontal (x-direction) and vertical (z-direction) anchoring forces required to hold the elbow in place. [7M]



5 a) Derive Hazen-Poiseuille equation and the state the assumptions made. [7M]

b) In a circular pipe of diameter 100mm, a fluid of viscosity 7poise and specific gravity 1.3 is flowing. If the maximum shear stress at the wall of the pipe is 196.2N/m^2, find the pressure gradient, the average velocity, and Reynolds number of the flow. [7M]

Or

6 a) Derive expressions for velocity distribution in terms of average velocity for smooth pipe and rough pipe. [7M]

b) A pipeline carrying water has surface protrusions of average height of 0.15 mm. If the shear stress developed is 4.9 N/m^2, determine whether the pipe surface acts as smooth, rough or in transition. The kinematic viscosity of water may be taken as 0.01 Stokes. [7M]

7 a) Obtain an expression for absolute pressure head at vena contracta for an external mouthpiece. [7M]

b) A submerged orifice 1m wide has height of water from the bottom and top of the orifice as 2.25m respectively. Find the discharge through the orifice, if the difference of water levels on both the sides of the orifice be the 375 mm. Take C_d as 0.62 for the orifice. [7M]

Or

8 a) Write the short notes on Narrow crested weir, ogee weir. [7M]

b) Water is flowing over a Cippoletti weir 4.0 m long under a head of 1.0 m. Calculate the discharge, if the coefficient of discharge for the weir is 0.6. [7M]

9 a) Define momentum thickness and energy thickness. [7M]

b) A smooth plate 2 m wide and 2.5 m long is towed in oil of specific gravity 0.8 at a velocity of 1.5 m/s along its length. Find the thickness of the boundary layer and shear stress at the trailing edge of the plate. Take Kinematic viscosity of the oil as 10^{-4} m^2/s. [7M]

Or

10 a) Explain the characteristics of laminar and turbulent boundary layers. [7M]

b) A plate 450 mm x 150 mm has been placed longitudinally in a stream of crude oil (specific gravity 0.925 and kinematic viscosity as 0.9 stokes) which flows with velocity of 6 m/s. Calculate the friction drag on the plate and thickness of the boundary layer at the trailing edge. [7M]