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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS3PCFMS **Max Marks: 100**
Course: Fluid Mechanics Systems **Date: 15.05.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Scientific calculator and steam data handbook are allowed to use.

UNIT - I

1 a) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m/s requires a force of 98.1 N to maintain the speed. Determine **10**

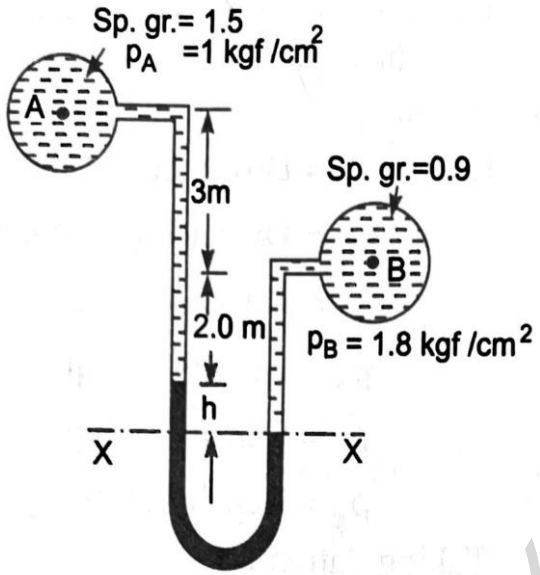
i) The dynamic viscosity of the oil in poise
ii) The kinematic viscosity of the oil in stokers if the specific gravity of the oil is 0.95.

b) Define the following **10**

i) Mass density ii) Specific weight iii) Specific gravity iv) Kinematic viscosity and v) Newton's law of viscosity.

OR

2 a) A differential manometer is connected at the two points A & B of two pipes as shown in the figure. The pipe A contains a liquid of sp. Gravity = 1.5 while the pipe B contains a liquid of sp. Gravity = 0.9. The pressures at A & B are 1 kgf/cm^2 & 1.80 kgf/cm^2 respectively. Find the difference in the mercury level in the differential manometer **08**



b) Calculate the pressure at a height of 7500 m above sea level if the atmospheric pressure is 10.143 N/cm^2 and temperature is 15^{o}C at the sea level i) air is incompressible ii) pressure variation follows isothermal law and iii) pressure variation follows adiabatic law. Take the density of air at the sea level as equal to 1.285 kg/m^3. Neglect variation of g with altitude. **12**

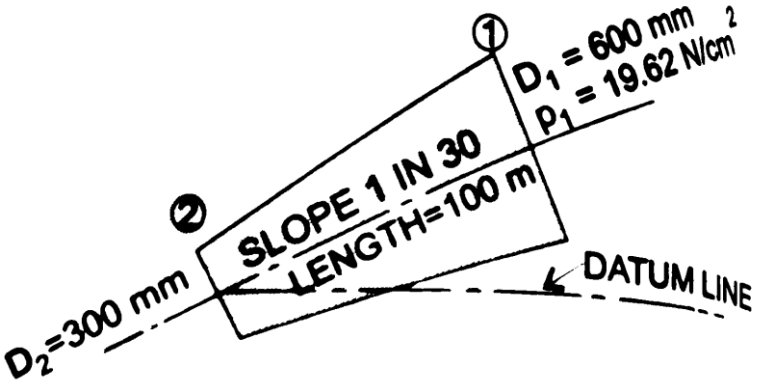
UNIT - II

3 a) Explain the types of fluid flow. **12**

b) The stream function for a 2D flow is given by $\psi = 2xy$, calculate the velocity at the point (2, 3). Find the velocity potential function ϕ. **08**

UNIT - III

4 a) The water is flowing through a taper pipe of length 100 m having diameter 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 liters/s. The pipe has a slope of 1 in 30. Calculate the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. **12**



b) Derive Euler's equation of motion. **08**

UNIT - IV

5 a) Derive an expression for Darcy-Weisbach equation. **10**

b) Calculate the head lost due to friction in a pipe of diameter 300 mm & length 50 m, through which water is flowing at a velocity of 3 m/s using i) Darcy formula ii) Chezy's formula for which C = 60. **10**

UNIT - V

6 a) Derive an expression for drag & lift. **08**

b) State buckingham's Π theorem. The efficiency η of a fan depends on the density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. **12**

OR

7 a) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$ Where u is the velocity at a distance y from the plate $u = U$ at $y = \delta$ and is boundary layer thickness. **10**

b) The pressure drop in an aeroplane model of size $\frac{1}{10}$of its prototype is 80 $\frac{N}{cm^2}$. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air as 1.24 $\frac{kg}{m^3}$. The viscosity of water is 0.01 $poise$ while the viscosity of air is 0.00018 $poise$. **10**

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