

Fluid Mechanics VTU CBCS Question Paper Set 2018

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OR

- 6 a. Explain the methods of dimensional analysis. (06 Marks)
- b. A 30cm × 15cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being up wards. The difference in elevation of the throat section and entrance section of the venturimeter is 30cm. The differential U-tube mercury monometer shown a gauge deflation 25cm. calculate :
- The discharge of oil, and
 - The pressure difference between entrance section and the throat section. Take the co-efficient of meter 0.98 and specific gravity of mercury as 13.6. (10 Marks)

Module-4

- 7 a. Explain the terms
- Major energy loss
 - Minor loss
 - Hydraulic gradient line
 - Total energy line. (10 Marks)
- b. Find the diameter of a pipe of length 2000mm when the rate of flow of water through the pipe is 200 l/s and the head lost due to friction is 4m take the value of $C = 50$ in Chezy's formula. (06 Marks)

OR

- 8 a. Derive an expression for laminar flow through circular pipe (Hagen Poiseuille equation]. (12 Marks)
- b. A crude oil of Kinematic viscosity 0.4 stokes is flowing through a pipe of diameter 300mm at the rate of 300 liters per second. Find the head lost due to friction for a length of 50m of the pipe. (04 Marks)

Module-5

- 9 a. Derive an expression for drag and lift. (08 Marks)
- b. Define :
- Boundary layer
 - Displacement thickness
 - Momentum thickness
 - Energy thickness. (08 Marks)

OR

- 10 a. Define mach number. With neat sketch, explain the propagation of disturbance for $M < 1$ and $M = 1$. (08 Marks)
- b. A flat plate 1.5m × 1.5m moves 50km/hour in stationary air of density 1.15kg/m³. If the co-efficient of drag and lift are 0.15 and 0.75 respectively. Determine :
- The lift force
 - The drag force
 - The resultant force
 - The power required to keep the plate in motion. (08 Marks)

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CBCS Scheme

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Fourth Semester B.E. Degree Examination, June/July 2017 Fluid Mechanics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Define following properties of fluid
- i) Density
 - ii) Specific volume
 - iii) Specific gravity
 - iv) Viscosity. (04 Marks)
- b. State and prove Pascal's law and hydrostatic law. (08 Marks)
- c. Find out the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is to be restricted to 2mm. consider surface interface with air as 0.0736 N/m. (04 Marks)

OR

- 2 a. Determine the total pressure on a circular plate of diameter 1.5m which placed vertically in water in such a way that the centre of the plate is 3m below the free surface of water. Find the position of centre of pressure also. (08 Marks)
- b. Explain pressure measurement method by manometer for flow through pipes. (04 Marks)
- c. Explain:
- i) Vapour pressure and cavitation
 - ii) Viscosity of fluids. (04 Marks)

Module-2

- 3 a. A block of wood of specific gravity 0.8 floats in water. Determine the meta centric height of the block if its size is 3m×2m×1m. State whether stable or unstable. (08 Marks)
- b. Derive the continuity equation in Cartesian coordinates with respect to steady flow and incompressible with definition express the continuity equation for steady flow and incompressible flow. (08 Marks)

OR

- 4 a. Derive the Euler's equation of motion along a stream line. Also derive Bernoulli's equation from Euler's equation of motion and list the assumptions made for deriving Bernoulli's equation. (04 Marks)
- b. A pipe of diameter 400mm carries water at velocity of 25m/s. The pressures at point A and B are 294.3 kN/m² and 225.63 kN/m² respectively while the datum head at A and B are 28m and 30m. Find the loss of head between A and B. (12 Marks)

Module-3

- 5 a. Derive the expression for rate of flow through venturimeter. (08 Marks)
- b. A submarine moves horizontally in sea and has its axis 15m below the surface of water. A pitot-tube properly placed just in front of the sub-marine and along its axis is connected to the two limbs of a U-tube containing mercury. The difference of mercury level is found to be 170mm. Find the speed of the submarine in km/hr knowing that specific gravity of mercury is 13.6 and that of sea water is 1.026 with respect of fresh water. (05 Marks)
- c. Differentiate V-notch and Rectangular notch related to discharge measurement. (03 Marks)

OR

- 6 a. The efficiency η of a fan depends on density ρ , dynamic viscosity μ of the fluid, angular velocity w , diameter D of rotor and the discharge Q , express η in terms of dimensionless parameter. (08 Marks)
- b. Define and explain :
- Reynold's number
 - Euler's number
 - Mach number
 - Froude number.
- (08 Marks)

Module-4

- 7 a. Derive Darcy-Weisbach expression for head loss due to friction in a pipe flow. (08 Marks)
- b. A pipe line 300mm in diameter and 3200m long is used to pump up 50kg/sec of an oil whose density is 950 kg/m^3 and whose density kinematic viscosity is $2.1 \times 10^{-4} \text{ m}^2/\text{sec}$. The centre of the pipe line at the upper end is 40m above than that at the lower end. The discharge at the upper end is atmospheric. Find the pressure at lower end. Draw the HGL and TGL. (08 Marks)

OR

- 8 a. Derive Hagen-Poiseuille equation for a laminar flow in a circular tube. (10 Marks)
- b. Water at 15°C flows through between two parallel plates at a distance of 1.6mm apart. Determine :
- The maximum velocity
 - Pressure drop/unit length
 - Shear stress at the plates is average velocity is 0.2 m/sec force viscosity of water at 15°C as 0.01 poise.
- (06 Marks)

Module-5

- 9 a. State the Bernoulli's theorem for compressible flow derives an expression for Bernoulli's equation when the process is isothermal. (08 Marks)
- b. Derive an expression for drag and lift with usual notation. (08Marks)

OR

- 10 a. A sub marine which may be supposed to approximate a cylinder 4m in diameter and 20m long travels submerged at 1.3 m/sec in sea water. Find the drag exerted on it, if the drag coefficient for Reynolds number greater than 10^5 may be taken as 0.75. The density of sea water is given as 10356 kg/m^3 and kinematic viscosity as 0.015 stokers. (06 Marks)
- b. A projectile travels in air of pressure 10.1043 N/cm^2 at 10°C at a speed of 1500km/hr. Find the mach number and the mach angle. Take $K = 1.4$ and $R = 287\text{J/kg K}$. (06 Marks)
- c. Define the terms subsonic and supersonic flow. (04 Marks)

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