SQ - 47

Seat No.	

Total No. of Pages : 03

S.Y.B.Tech. (Part - II) (Semester - III) (CBCS)
Examination, MAY 2025
(Mechanical)
Fluid Mechanics
Sub. Code : 73207/63354/77738

Day and Date : Friday, 09.05.2025 **Total Marks : 70**

Time : 10.30 a.m. to 1.00 p.m.

Instructions : 1) All questions are compulsory.

2) Figures to right indicates full marks.

3) Draw neat sketches wherever necessary.

Q.1) Solve Any Two of following.

A) State and prove Newton's law of viscosity with neat sketch. **(5)**

B) State or define the following terms : **(5)**

i) Pascal's law ii) Hydrostatic law iii) Meta centre

iv) Centre of Buoyancy v) Total pressure.

C) A single column 'U' tube manometer, made of glass tubing having a nominal inside diameter of 2.4 mm, has been used to measure pressure in a pipe or vessel containing air. If the limb opened to atmosphere is 10% oversize, find the error in mm of mercury in the measurement or air pressure due to surface tension effects. For mercury surface tension $\sigma = 0.52$ N/m and angle of contact $\theta = 140^0$. **(7)**

Q.2) Solve Any Two of following.

A) Define i) Stream tube ii) Path line iii) Velocity potential Function **(6)**

B) Derive general continuity equation in three dimensions in Cartesian coordinate system for compressible and unsteady flow. **(6)**

C) For the following Stream functions calculate velocity at a point (1,2) **(6)**

i) $\psi = 3xy$ ii) $\psi = 3x^2y - y^3$

Q.3) Solve Any Two of following.

A) Derive Euler's equation of motion. **(6)**

B) State law of conservation of energy, Write the statement of Bernoulli's theorem and obtain Bernoulli's equation from Euler's equation of motion. **(5)**

C) A tank has 2 identical orifices on one of its vertical sides. The upper orifice is 3 meters below the water surface and lower one is 5 meters below the water surface. If the value of Cv for each orifice is 0.96, find the point of intersection of the two jets. **(6)**

Q. 4) Solve Any Two of following.

A) Derive an expression for force exerted by flowing fluid on a pipe bend. **(5)**

B) Derive an expression for velocity distribution for viscous flow through a circular pipe. Also draw the velocity distribution and shear stress distribution across the section of the pipe. **(6)**

C) Water at 20^0C flows between two large parallel plates separated by a distance of 16 mm. Calculate the maximum velocity and shear stress at the wall, if the average velocity is 0.4 m/s. Take dynamic viscosity of water as 0.01 poise. **(6)**

Q. 5) Solve Any Two of following.

A) Define the following terms : **(5)**

i) Hydraulic Gradient Line (ii) Compound pipe

iii) Equivalent pipe iv) Branched pipe v) Syphon pipe

B) Derive the Chezy's formula for loss of head due to fluid friction in a circular pipe flow. **(5)**

C) In a pipe of diameter 350 mm and length 75 m, water is flowing at a velocity of 2.8 m/s. Find the head lost due to friction using : **(6)**

i) Darcy-Weisbach formula ii) Chezy's formula for which C = 55.

Assume kinematic viscosity of water as 0.012 stokes.

Q.6) A) Explain with neat sketch, methods of preventing the separation of boundary layer. **(6)**

B) Explain with neat sketch the following terms : **(6)**

i) Bluff body ii) Stalling condition for an airfoil.

C) A flat plate 1.5 m x 1.5 m moves at 50 km/hr in stationary air of density 1.15 kg/m^3. If coefficients of drag and lift are 0.15 and 0.75 respectively, determine : i) The lift force ii) The drag force iii) the resultant force. **(6)**