

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (Special Examinations) (FT/S1PT) January 2026 (2015 Scheme)

Course Code: CE203

Course Name: FLUID MECHANICS - I

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) An inverted manometer is connected to two pipes A and B carrying water at different pressures. The pressure of water in pipe A is 3 m of water, find the pressure of water flowing through pipe B. The manometric surface in the left limb is 40 cm above the centre of pipe A, while the manometric surface in the right limb is 15 cm above the centre of pipe B. The manometric surface in the left limb is above the manometric surface of right limb by 10 cm. Oil of specific gravity 0.8 is used as the manometric fluid (8)
- b) Derive pascal's law. (7)
- 2 a) A ship 60 m long and 10 m wide displaces 15 MN of water. A weight of 200 kN is displaced across the deck through a distance of 5 m and the ship is tilted through 4.5° . The moment of inertia of the ship about its fore-and aft axis is 80% of the circumscribing rectangle. The centre of buoyancy is 2m below the water surface. Determine (a) metacentric height and (b) position of centre of gravity of the ship. Take specific gravity of water = 1.03. (8)
- b) Obtain the expression for centre of pressure of a planar lamina placed vertically in a liquid. (7)
- 3 a) The flow field is given by $\Psi = x^3y$. Check whether the given field exists or not? Further check whether it is rotational or not. (6)
- b) A tank 1.5 m x 1.5 m x 1.5 m is filled with water upto 0.5 m height and remaining is filled with an oil of 0.8 relative density. Determine total pressure force acting on one side of the tank and position of centre of pressure. (9)

PART B*Answer any two full questions, each carries 15 marks.*

- 4 a) A venturimeter 35 cm x 16 cm is used for measuring the discharge of oil of specific gravity 0.85, passing through an inclined pipe and water is flowing in the downward direction. The loss of head between the main and throat is 0.25 times the kinetic head in the pipe. The head recorded by an inverted manometer is 30 cm. The liquid used in manometer has 0.6 specific gravity. Find the discharge and pressure difference between the entrance and throat section. (9)
- b) Explain about different types of orifices. (6)
- 5 a) Explain the experimental determination of hydraulic coefficients. (6)
- b) A hemi-spherical tank of 4 m diameter contains water upto the depth of 1.5 m. Find the time taken for discharging the water through a orifice of 25 cm² area and $C_d = 0.62$, (i) when the depth inside decreases from 1.5 m to 1 m and (ii) when it is made completely empty. (9)
- 6 a) A broad crested weir of 50 m width carries water 0.5 m above its crest. Find the maximum discharge. Take $C_d = 0.6$. Also find the discharge if the velocity of approach is considered, channel cross-section = 40 m². (8)
- b) Explain about Cipolletti weir. What is its advantage? (7)

PART C*Answer any two full questions, each carries 20 marks.*

- 7 a) Explain the different types of losses. (8)
- b) Three pipes of 40 cm diameter- 300 m long, 20 cm diameter- 400 m long and 30 cm diameter- 200 m long are connected in series and the ends are connected to two tanks whose water level difference is 20 m. Find the discharge through the compound pipe (a) considering only frictional losses (b) considering all losses. Take $f = 0.005$ for all pipes (12)
- 8 a) Derive the equation for head loss for (i) pipes in series and (ii) pipes in parallel. (7)
- b) An oil of specific gravity 0.85 and viscosity = 2.5 poise is flowing through a 30 cm diameter pipe. The length of pipe is 2.5 km and head loss is 20 m. Find out : (13)
- (i) shear stress at the pipe wall
- (ii) shear stress at $r = 10$ cm from the centre of pipe.
- (iii) value of friction factor if the flow is laminar

- 9 a) Explain separation of boundary layer and methods to control it. (5)
- b) Describe about displacement thickness, momentum thickness and energy thickness. (5)
- c) A plate of 1 m length and 0.6 m wide is held on a horizontal plane. A fluid (specific gravity 0.9 and kinematic viscosity $10^{-4} \text{ m}^2/\text{s}$) is flowing over a plate with a velocity of 5 m/s parallel to 1 m side of the plate. Find the boundary layer thickness and shear stress at the end of the plate. (10)
