Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination December 2020 (2015 Scheme)

Course Code: ME200

Course Name: FLUID MECHANICS AND MACHINERY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions, each carries 10 marks. Marks

1 a) Explain mass density, specific weight, specific gravity and specific volume. (5)

b) A stone weighs 392.4 N in air and 192.2 N in water. Compute the volume and specific gravity of the stone. Take density of water as 1000 Kg/m^3. (5)

2 a) Explain bulk modulus and compressibility. (4)

b) State Newton's law of viscosity. A thin moving plate is separated from two fixed plates by two fluids of unequal viscosity μ1 & μ2 and unequal spacing d1 & d2. The contact area is A. Determine the force F required to move the plate with a velocity V. (6)

3 a) State and prove Pascal's law. (7)

b) Explain Centre of pressure, centre of buoyancy and centre of gravity (3)

4 a) What is metacentric height? Derive the expression for metacentric height (6)

b) Explain the conditions of equilibrium of floating and submerged bodies. (4)

PART B

Answer any three questions, each carries 10 marks.

5 a) Explain stream line, streak line and path line (4)

b) A pipe of 50 mm diameter is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2 m length of pipe was replaced by 75 mm diameter pipe, the change of section being sudden? Take friction factor = 0.04 for the pipes of both diameters. (6)

6 a) Derive Bernoulli equation for fluid motion. State the assumptions. (5)

b) Derive the condition for maximum power transmitted through pipes. (5)

7 a) Sketch and explain the development of boundary layer on a flat plate which is held horizontally in a flow of viscous fluid. (5)

b) What is displacement thickness? Derive the expression for displacement thickness. (5)

8 a) Explain separation of boundary layer. For the following velocity profiles, determine whether the flow has separated, or on the verge of separation or will attach with the surface. (5)

(i) $u/U = 2(y/\delta)^2 - (y/\delta)^3$

(ii) $u/U = -2(y/\delta) + (y/\delta)^2$ where δ is the boundary layer thickness.

b) A pitot tube is inserted in a pipe of 30 cm diameter. The static pressure of the tube is 10 cm of mercury (vacuum pressure).The stagnation pressure at the centre of the pipe recorded by the pitot tube is 1.0 N/cm^2. Calculate the rate of flow of water through the pipe, if the mean velocity of flow is 0.85 times the central velocity. Assume coefficient of the tube to be 0.98. (5)

PART C

Answer any four questions, each carries 10 marks.

9 a) Derive the expression for force exerted by a jet striking at the centre of a stationary flat vertical pate. (6)

b) A jet of water 50 mm diameter having a velocity 40 m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of jet, if the jet is deflected through an angle of 120 ° at the outlet of the curved plate. (4)

10 A Pelton wheel is to be designed for a head of 60 m when running at 200 r.p.m. The Pelton wheel develops 96 KW shaft power. The velocity of the buckets is 0.45 times the velocity of jet, overall efficiency is 0.85 and coefficient of velocity is 0.98. (10)

11 a) Explain draft tube. (4)

b) A Kaplan turbine produces 60,000 kW under a net head of 25 m with an overall efficiency of 90 %. If the speed ratio is 1.6, flow ratio is 0.5, and the hub diameter is 0.35 times the outer diameter, Find the diameter and speed of the turbine. (6)

12 a) Explain slip in reciprocating pumps. What is an indicator diagram? (5)

	b)	Find the power required to drive a centrifugal pump which delivers 40 litres of water per second to a height of 20 m through a 150 mm diameter and 100 mm long pipe. The overall efficiency of the pup is 70 %. And Darcy's f = 0.006 for the pipe line. Assume inlet loss in suction pipe is 0.33m.	(5)
13	a)	Explain the working of air vessels.	(4)
	b)	Explain the working of centrifugal pump with neat sketch.	(6)
14	a)	Derive specific speed of a centrifugal pump. What is NPSH?	(6)
	b)	Why is priming necessary in centrifugal pumps?	(4)

****