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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination January 2022 (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)	Illustrate different types of fluids	(4)
	b)	Differentiate mass density and weight density. Also calculate the weight density, mass density and specific gravity of three litres of a fluid which weighs 22 N.	(6)
2	a)	State Newton's Law of viscosity. Distinguish between kinematic viscosity and absolute viscosity.	(4)
	b)	A plate having an area of $0.6m^2$ is sliding down the inclined plane at 60^0 to the vertical with a velocity of 0.36 m/s. There is a fluid layer 1.8mm thick between the plate and the plane. Find the absolute viscosity of the fluid if the mass of the plate is 28.55kg	(6)
3	a)	With a neat sketch, illustrate the working principle of a differential manometer	(4)
	b)	An inverted differential manometer containing an oil of specific gravity 0.9 is connected to find the difference of pressures at two points of a pipe containing water. If the manometer reading is 40 cm, find the difference of pressures.	(6)
4	a)	State and prove Pascal's Law	(4)
	b)	Determine the total pressure on a circular plate of diameter 1.6 m which is placed vertically in water in such a way that the centre of the plate is 2.5 m below the free surface of water. Find the position of centre of pressure also.	(6)

PART B

Answer any three questions, each carries 10 marks.

5	a)	The diameters of a pipe at sections 1 and 2 are 16cm and 22 cm respectively. Find the discharge through the pipe if the velocity of water at section 1 is 4.5m/s. Determine also the velocity at section 2.	(4)

b) Distinguish between (i) rotational flow and irrotational flow. (6)
(ii) laminar and turbulent flow

6 a) Illustrate the terms (a) Hydraulic gradient line and (b) Total energy line. (4)

b) Prove that the head loss due to friction is equal to one third of the total head at inlet for maximum power transmission through pipes. (6)

7 a) Derive an expression for the displacement thickness. (4)

b) Find the displacement thickness and the momentum thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ (6)

8 a) Compare venturimeter and orificemeter. (4)

b) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 11 cm is used to measure the flow of water. The pressure at inlet is 176.58 kPa and the vacuum pressure at the throat is 28cm of Hg. Find the discharge of water through venturimeter. Take $C_d = 0.98$ (6)

PART C

Answer any four questions, each carries 10 marks.

9 a) Derive an expression for the force excerted on a moving curved vane. (4)

b) A jet of water having a velocity of 35 m/s strikes a curved vane, which is moving with a velocity of 20 m/s. The jet makes an angle of 30^0 with the direction of motion of vane at inlet and leaves at an angle of 90^0 to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and also determine the vane angles at inlet and outlet. (6)

10 a) Make a comparison between impulse and reaction turbines. (4)

b) A pelton wheel generates 7000 kW under a net head of 120m at a speed of 250rpm. Assume Cv = 0.98, Overall efficiency = 65%, speed ratio = 0.46, d/D = 1/9. Determine discharge, size of wheel and number of jets. (6)

11 a) What are the functions of a draft tube? (4)

b) A Kaplan turbine produces 35000kW under a head of 20m, with an overall efficiency 90%. Taking the value of speed ratio as 1.6, flow ratio as 0.5 and the hub diameter as 0.35 times the outside diameter, find the runner diameter and speed of the turbine. (6)

12 a) Derive an expression for the head loss due to friction in the delivery pipe of a reciprocating pump with an air vessel. (4)

b) A single acting reciprocating pump has a plunger diameter of 230 mm and stroke of 430mm and it is driven with SHM at 70rpm. The length and diameter of delivery pipe are 60m and 100mm respectively. Determine the power saved in overcoming friction in the delivery pipe by fitting an air vessel on the delivery side of the pump. Assume f = 0.01 (6)

13 a) What is priming? Why is it necessary? (4)

b) The impeller of a centrifugal pump has an external diameter of 430mm and internal diameter 0f 210mm and it runs at 1500 rpm. Assuming a constant radial flow through the impellar at 2.5m/s and that the vanes at exit are set back at an angle of 25^0. Determine the inlet vane angle, exit angles and the workdone per N of water. (6)

14 a) Illustrate the features of multistaging of pumps. (4)

b) Derive the expression for the minimum speed required for starting a centrifugal pump. (6)

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