Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD/FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

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)	Define the following: i) Newton's law of viscosity ii) Specific weight iii) Ideal fluids.	(3)
	b)	The pressure outside the droplet of water of diameter 0.04mm is 10.32N/cm^2 (atmospheric pressure). Calculate the pressure within the droplet if surface tension is given as 0.0725N/m of water.	(3)
	c).	Calculate the capillary rise or fall in a glass tube of 2.5mm diameter when immersed vertically in (i) water and (ii) mercury respectively. Take surface tension as 0.0725N/m for water and 0.52N/m for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact as 130^o	(4)
2	a)	Differentiate between Newtonian and non-Newtonian fluids.	(3)
	b)	Two large plane surfaces are 2.4 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of surface area 0.5square metre between the two large plane surfaces at a speed of 0.6m/s, if: a) the thin plate is in the middle of the two plane surfaces. b) the thin plate is at a distance of 0.8cm from one of the plane surfaces? Take the dynamic viscosity of glycerine as 8.10 x10^{-1} Ns/m^2.	(7)
3	a)	Define vacuum, gauge and absolute pressure and plot its relationship.	(4)
	b)	List down the types of mechanical pressure gauges and explain the working principle of any one with neat sketch.	(6)
4	a)	Define centre of pressure and centre of buoyancy.	(3)
	b)	A U tube manometer is used to measure the pressure of water in a pipeline, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U-tube is 10cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipeline is reduced to 9810N/m^2, calculate the new difference in the level of mercury. Sketch the arrangements in both cases.	(7)

PART B

Answer any three questions, each carries 10 marks.

5	a)	Derive Euler's equation of motion and list down the assumptions made in it.	(6)
	b)	List down the major and minor losses in pipes.	(4)
6	a)	With neat sketches, derive the continuity equation for a 3D flow.	(6)
	b)	Water is flowing through the pipe of diameter 200mm with a velocity of 3m/s. find the head lost due to friction for a length of 5m if the co-efficient of friction is given by f=0.02+(0.09/$R_e^{0.3}$), where R_e is Reynolds number. The kinematic viscosity of water = 0.01 stroke.	(4)
7	a)	List the different methods to prevent the separation of boundary layer.	(4)
	b)	A pitot tube is inserted in a pipe of 300 mm diameter. The static pressure in the pipe is	(6)

100mm of mercury (vacuum). The stagnation pressure at the centre of the pipe, recorded by the pitot-tube is 0.981N/cm^2. Calculate the rate of flow of water through pipe, if the mean velocity of flow is 0.85 times central velocity. Take C_v=0.98.

8 a) Derive the expression to find the discharge of Venturimeter. (8)

b) Differentiate Pitot tube and Pitot –static tube (2)

PART C

Answer any four questions, each carries 10 marks.

9 a) A Pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 litres/sec under a head of 30m. The buckets deflect the jet through an angle of 160 degree. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. (6)

b) Explain about draft tubes and its types. (4)

10 The following data is given for a Francis Turbine. Net head H= 60m; speed N=700r.p.m; shaft power=293.3kw; η_o =84%; η_h=93%; flow ratio= 0.20; breadth ratio n = 0.1; outer diameter of the runner = 2 x inner diameter of runner. The thickness of the vanes occupies 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine (10)

i) Guide blade angle ii) Runner vane angles at inlet and outlet

iii) Diameters of runner at inlet and outlet iv) Width of the wheel at inlet.

11 Explain about construction and working of centrifugal pump. (10)

12 The length and diameter of a suction pipe of a single-acting reciprocal pump are 5m and 10 cm respectively. The pump has a plunger of diameter 15 cm and a stroke length of 35cm. the centre of the pump is 3m above the water surface in the pump. The atmospheric pressure head is 10.3 m of water and the pump is running at 35 r.p.m. if the length and diameter of the delivery pipe is 30m and 10cm respectively and water is delivered by the pump to a tank which is 20 m above the centre of the pump. (10)
Determine i) pressure head due to the acceleration at the beginning of the suction stroke,

ii) Maximum pressure head due to acceleration,

iii) Pressure head in the cylinder at the beginning and at the end of the stroke,

iv) Pressure head in the cylinder at the beginning of the delivery stroke.

13 Explain the parts, construction and working principle of Kaplan turbine. (10)

14 a) Find the power required to drive a centrifugal pump which delivers 0.4m^3/s of water to a height of 20 m through a 15 cm diameter pipe and 100 m long. The overall efficiency of the pump is 70% and co-efficient of friction f = 0.15 in the formula ($h_f = 4fLV^2/d2g$). (5)

b) A four-stage centrifugal pump has four identical propellers, keyed to the same shaft. The shaft is running at 400 r.p.m. and the total manometric head developed by the multistage pump is 40m. The discharge through the pump is 0.2 m^3/s. the vanes of each impeller are having outlet angle as 45 degrees. If the width and diameter of each impeller at outlet is 5cm and 60cm respectively. Find the manometric efficiency. (5)

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