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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: CE206

Course Name: FLUID MECHANICS II (CE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions. Each question carries 15 marks.

1	a)	Derive the expression for work done by the jet per second on a moving flat plate.	(5)
	b)	A Pelton wheel has a mean bucket speed of 15 m/s and is supplied with water at a rate of 0.850 m^3/s under a head of 40m. If the bucket deflects the jet through an angle of 150^o, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if its mechanical efficiency is 78%.	(10)
2	a)	Compare the velocity triangles for a Francis turbine and that of a Centrifugal pump.	(5)
	b)	A jet of water moving at 18 m/s impinges on a symmetrical curved vane shaped to deflect the jet through 120^0. If the vane is moving at 4m/s, find the angle of the jet so that there is no shock at inlet. Also calculate the work done per unit weight of water.	(10)
3	a)	What is priming of a centrifugal pump. Why is it necessary?	(5)
	b)	A centrifugal pump delivers water against a net head of 15m and a design speed of 1200 rpm. The vanes are curved back at an angle of 30^0 with the periphery. The impeller diameter at the outlet is 300mm and the outlet width is 60mm. Determine the discharge of the pump if manometric efficiency is 96%. Assume outflow as radial at outlet.	(10)

PART B

Answer any two full questions. Each question carries 15 marks.

4	a)	Compare Open channel flow and pipe flow.	(5)
	b)	A flow of 150 litres per second flows through a rectangular flume of width 0.5m and having adjustable bottom slope. If Chezy`s constant, C is 50, determine the bottom slope necessary for uniform flow with a depth of 0.4m. Also determine the conveyance and state of flow.	(10)
5	a)	What is meant by most economical section of an open channel? Enumerate the conditions for rectangular and trapezoidal channel to be most economical.	(5)
	b)	Draw the specific energy diagram showing critical point where the specific energy is minimum. Prove that E_{min} = (3/2) y_c for a rectangular channel section, where y_c is the critical depth.	(5)
	c)	A 4m wide rectangular channel discharges 16m^3/s of water at a depth of 3m. Calculate (i) specific energy (ii) critical depth (iii) minimum specific energy.	(5)

6	a)	Define hydraulic jump. What are the practical applications of a hydraulic jump?	(5)
	b)	A horizontal rectangular channel 3.5m wide carries discharge of $15m^3/s$. Check whether a jump may occur at an initial depth of 0.55m or not. If a jump occurs, determine the sequent depth to this initial depth. Also calculate the energy loss in the jump.	(10)

PART C

Answer any two full questions. Each question carries 20 marks

7	a)	Derive the dynamic equation for gradually varied flow.	(8)
	b)	Assuming that the rate of discharge Q of a centrifugal pump is dependent upon the mass density ρ of the fluid, pump speed N (rpm), diameter of the impeller D, the pressure p and the viscosity of fluid μ, show using the Buckingham`s π theorem that it can be represented by $$Q = (ND^3)\ \phi\ [(gH/N^2D^2), (\upsilon/ND^2)]$$ Where H= head and υ= kinematic viscosity of the fluid, g = acceleration due to gravity.	(12)
8	a)	Sketch the water surface profiles occurring in mild slope channel and steep slope channel.	(10)
	b)	Design a concrete lined channel to carry a discharge of $500m^3/s$ at a slope of 1 in 4000. The side slopes of the channel may be taken as 1:1. The Manning`s roughness coefficient for the lining is 0.014. Assume permissible velocity in the section as 2.5m/s.	(10)
9	a)	What is dimensional homogeneity?	(4)
	b)	A 1:10 scale model of a passenger car is tested in a wind tunnel. The prototype velocity is 40kmph. If the model drag is 350N, what is the drag and the power required to overcome the drag in the prototype. Assuming the air in the model and prototype to have the same properties.	(10)
	c)	Explain the different types of similarities.	(6)

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