P P SAVANI UNIVERSITY

Forth Semester of B. Tech. Examination

May 2019

SECV 2071 Advanced Fluid Mechanics & Hydraulic Machine

20.05.2019, Monday **Time: 09:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1	Answer the Followings: (Any Five)	**[05]**
(i)	Write an equation for loss of head due to friction in Viscous flow.	
(ii)	Write different condition's when Laminar flow changes to Turbulent flow.	
(iii)	What is Momentum thickness in Boundary layer concept?	
(iv)	Define Gradually Varied Flow.	
(v)	Write Von Karman momentum integral equation.	
(vi)	Define Sub-critical Flow.	
(vii)	What is Chezy's formula of Velocity?	
Q - 2 (a)	An oil of viscosity 0.1 Ns/m² and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and length of 300 m. The discharge is 3.5 lit/s. Find the pressure drop in a length of 300 m.	**[05]**
Q - 2 (b)	Write a Short Note on Hydrodynamically Smooth and Rough boundaries.	**[05]**
	OR	
Q - 2 (a)	Discuss flow of viscous fluid with circular pipe along with shear stress distribution in section.	**[05]**
Q - 2 (b)	Discuss observation made in Reynolds's experiment with diagramme.	**[05]**
Q - 3 (a)	For a given velocity profile, find the thickness of boundary layer at the end of the plate and the frag force on side of a plate 1 m long and 0.8 m wide when placed in water flowing with a velocity of 150 mm/s. Calculate the value of co-efficient of drag. μw=0.01 poise. $\frac{u}{U} = 2(y/\delta) - (y/\delta)^2$	**[05]**
Q - 3 (b)	Find the velocity of flow and rate of flow of water through a rectangular channel of 6 m wide and 3 m deep, when it is running full. The channel is having bed slope as 1 in 2000. Take C = 55.	**[05]**
	OR	
Q - 3 (a)	List out methods of preventing the separation of boundary layer.	**[05]**
Q - 3 (b)	Write a Short Note on Short Note on Hydraulic Jump.	**[05]**
Q - 4	Attempt any One.	**[05]**
(i)	A trapezoidal channel with side slopes of 3 H to 2 V has to be designed to convey 10 m³/s at a velocity of 1.5 m/s, so that the amount of lining for bed and slope is minimum. Find the wetted perimeter of channel.	
(ii)	A plate of 600 mm length and 400 mm wide is immersed in a fluid of Sp. Gravity 0.9 and kinematic viscosity is 0.0001 m²/s. The fluid is moving with a velocity of 6 m/s. Determine boundary layer thickness and drag force on one side of plate.	

SECTION – II

Q - 1	Answer the Followings: (Any Five)	**[05]**
(i)	What is undistorted models?	
(ii)	Define Hydraulic efficiency of turbine	
(iii)	Write an equation for the force exerted by a jet of water on a stationary inclined flat plate in the direction of jet.	
(iv)	How prototype differ from Model?	
(v)	Determine the dimensions of Discharge.	
(vi)	Determine the dimensions of Specific weight.	
(vii)	Define Overall Efficiency of Turbine.	
Q - 2 (a)	Give detail classification of hydraulic turbine. Describe with neat sketches the function of various main components of Radial Reaction Turbine.	**[05]**
Q - 2 (b)	A Centrifugal pump delivers water against a net head of 14.5 meters and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30◦ with the periphery. The impeller diameter is 300 mm and outlet width is 50 mm. Determine the discharge of the pump if manometric efficiency is 95%.	**[05]**
	OR	
Q - 2 (a)	Show that the angle of swing of a vertical hinged plate is given by $\sin\theta = \frac{\rho a V^2}{W}$.	**[05]**
Q - 2 (b)	Explain different types of hydraulic similarity that must exist between a prototype and its model.	**[05]**
Q - 3 (a)	A single acting reciprocating pump, running at 50 r.p.m, delivers 0.01 m3/s of water. The diameter of the piston is 200mm and stroke length 400 mm. Determine: (i) The theoretical discharge of the pump, (ii) Co-efficient of discharge, and (iii) Slip and the percentage of the pump.	**[05]**
Q - 3 (b)	Explain Buckingham π – theorem method.	**[05]**
	OR	
Q - 3 (a)	What is draft tube? Describe with neat sketches different types of draft tube.	**[05]**
Q - 3 (b)	A jet of water of diameter 10 cm strikes a flat plate normally with a velocity ofn15 m/s. The plate is moving with a velocity of 6 m/s in the direction of the jet and away from the jet. Find (i) Force exerted by the jet on the plate (ii) Work done by the jet on the plate per second (iii) Power of the jet in kw (iv) Efficiency of the jet.	**[05]**
Q - 4	Attempt any one.	**[05]**
(i)	Explain cavitation in turbines. Write the effects of cavitation. Give necessary precaution against cavitation.	
(ii)	Differentiate between centrifugal pumps and reciprocating pumps.	

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