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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Civil Engineering

Semester End Examination; July / August - 2022

Hydraulics and Hydraulic Machines

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of basic science, mathematics and fundamentals of engineering to understand, classify, formulate and analyze problems related with open channel, hydraulic jump, impact of jet on vanes, pumps, turbines and to do dimensional analysis and model analysis

CO2: Compute the discharge in different types channel sections, design most economical channel sections, analyze and interpret the data of various flow phenomenon to establish relationship among the variables in flow phenomenon

CO3: Select the models of various hydraulic structures, design the components of Turbines and Centrifugal pumps and evaluate the performance of Turbines and Centrifugal pumps under different conditions.

CO4: Apply the knowledge of open channel flow, hydraulic machines and model analysis in future to work effectively either as an individual or as a team member to satisfy the changing professional and societal needs.

Note: *i) PART-A is compulsory. One question from each unit for maximum of 2 marks.*
*ii) PART-B: Answer any **TWO** sub questions (from a, b, c) from each unit for a Maximum of 18 marks.*

Q. No.	Questions	Marks	BLs	COs
	I : PART - A	**10**		
I a.	Define specific energy with equation.	2	L2	CO1
b.	Define Reynold's number with its Expressions.	2	L2	CO1
c.	State impulse momentum Equation	2	L1	CO1
d.	Define Hydraulic efficiency and Mechanical efficiency.	2	L2	CO1
e.	What do you mean by priming in centrifugal Pumps?	2	L1	CO1
	II : PART - B	**90**		
	UNIT - I	**18**		
1 a.	Derive an expression for Hydraulic Jump in rectangular channel.	9	L4	CO2
b.	Explain various types of flow in channels.	9	L2	CO2
c.	Find the bed slope of trapezoidal channel of bed with width of 4 m. Depth of water 3 m and side slope of 2H: 3V, when the discharge through the channels is 20 m^3/sec. Take Manning's N = 0.03.	9	L3	CO2
	UNIT - II	**18**		
2 a.	Explain Dimensionally homogeneous equation. Give any two examples.	9	L2	CO2
b.	The pressure difference ΔP in a pipe of diameter D and length '*l*' due to viscous flow depends on the velocity 'V' , Viscosity 'μ' and density 'ρ'. Using Buckingham's π-theorem, obtain an expression for ΔP.	9	L3	CO2
c.	A 1:64 model is constructed of an open channel in concrete which has Manning's N= 0.014. Find the value of 'N_m' Using Froude's model law.	9	L3	CO2

Contd…2

UNIT - III **18**

3 a.	Derive an expression for force exerted by a jet on stationary curved plate. i) When Jet Strikes the curved plate at one end tangentially when the plate is symmetrical? ii) When Jet strikes the curved plate at one end tangentially when the plate is unsymmetrical?	9	L4	CO2
b.	A Jet of water having a diameter 75mm strikes a symmetrical curved vane at its centre with a velocity of 20m/s. The vane is moving with a velocity of 8 m/s in the direction of jet. The jet is deflected at an angle of 165°. Assume the vane to be smooth, determine the force exerted on the vane in the direction of Jet, power of Jet and efficiency of Jet.	9	L3	CO4
c.	Derive an expression for force exerted on a series of curved vanes and its efficiency.	9	L4	CO2

UNIT - IV **18**

4 a.	Explain General layout of Hydro electric Power plant with a neat sketch.	9	L2	CO3
b.	Explain the component of pelton wheel turbine with a neat sketch.	9	L2	CO3
c.	A Francis turbine with an overall efficiency of 75% is required to produce 148.25 KW power. It is working under a head of 7.62 m. The peripheral velocity $= 0.26\sqrt{2gh}$ and t the radial velocity of flow at inlet is $0.96\sqrt{2gh}$. The Wheel runs at 150 rpm and the hydraulic losses are 22% of available energy. Assuming radial discharge, determine; i) The guide blade angle ii) The wheel Vane angle at inlet iii) Diameter of the wheel at inlet iv) Width of the wheel at inlet	9	L3	CO4

UNIT - V **18**

5 a.	Derive an expression for minimum starting speed of centrifugal pumps.	9	L4	CO2
b.	Explain the following terms with their expressions. i) Unit Speed ii) Unit Discharge iii) Unit Power	9	L2	CO3
c.	A centrifugal pump is running at 1000 rpm. The outlet Vane angle of the impeller is 45° and velocity of flow at outlet is 2.5 m/s. The discharge through the pump is 200 liters/sec when the pump is working against a total head of 20m. If the Manometric efficiency of pump is 80%, determine; i) Diameter of the impeller ii) Width of the impeller at outlet	9	L3	CO4

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