Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Fluid Mechanics and Machinery **Semester: V**
Program: B. Tech (Mechatronics) **Time 03 hrs.**
Course Code: MECH 3004 **Max. Marks: 100**

Instructions: **Note: Attempt all questions, internal choices are given. Section B and Section C, both having ONE INTERNAL choice.**

SECTION A

S. No.		Marks	CO
Q 1	Explain with the help of sketch working of Bourdon tube pressure gauge.	**05**	**CO1**
Q2	Discuss Geometric, Kinematic and Dynamic similarity. Illustrate with suitable examples where these fundamentals have been useful to reduce time and efforts for the design and development.	**05**	**CO2**
Q3	Define various efficiencies of centrifugal pump.	**05**	**CO1**
Q4	Derive an expression to determine length of equivalent pipe, in case of pipes are connected in parallel to each other.	**05**	**CO2**
	SECTION B		
Q5	Show that the streamlines and equipotential lines form a net of mutually perpendicular lines.	**10**	**CO2**
Q6	Derive the expression for minor losses in pipe due to sudden enlargement and sudden contraction.	**10**	**CO2**
Q7	The velocity along the centerline of the Hagen-poiseuille flow in a 0.1 m diameter pipe is 2 m/s. If the viscosity of the fluid is 0.07 kg/ms and its specific gravity is 0.92, calculate (a) volumetric flow rate (b) shear stress of the fluid at the pipe wall (c) Darcy friction coefficient.	**10**	**CO3**
Q8	A jet of water of diameter 40 mm moving with a velocity of 30 m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the water jet in the	**10**	**CO3**

	direction of the jet, if the jet is deflected through an angle of 120˚ at the outlet of the curved plate.		
	OR		
	A jet of water of 20 mm diameter and moving at 15 m/s, strikes upon the centre of a fixed symmetrical vane. After impingement, the jet gets deflected through 160˚ by the vane. Presuming vane to be smooth determine force exerted by jet on the vane.	**10**	**CO3**
SECTION-C			
Q9	Three pipes -300 m long of 30 cm diameter, 150 m long of 20 cm diameter and 200 m long of 25 cm diameter – are connected in series in the same order as indicated above between a high level reservoir and low level reservoir. The friction factor f for the pipes are: 0.018, 0.02 and 0.019 respectively. Determine the rate of flow for a difference in elevation of 15 m between the two reservoirs. Account for all losses. Contractions and expansion are sudden. (Assume k for contraction = 0.30)	**20**	**CO4**
Q10	(A) A centrifugal pump with 40 cm impeller diameter delivers 75 L/s of oil of relative density 0.85 at a tip speed of 25.1 m/s. The flow velocity is constant that to 2.0 m/s and the outlet blade is curved backwards at an angle of 35˚. The overall efficiencies 88%. (a) Calculate the brake power and torque applied to the pump shaft. (b) If the inlet diameter is 25 cm, calculate the inlet-blade angle.	**10**	**CO5**
	(B) Explain different types of energy losses encountered in centrifugal pumps.	**10**	**CO2**
	OR		
	(A) In an inward flow reaction turbine the head on the turbine is 32 m. The external and internal diameter are 1.44 m and 0.72 m respectively. The velocity of flow through the runner is constant and equal to 3 m/s. The guide blade angle is 10˚ and the runner vanes are rigid at inlet. If the discharge at outlet is radial, determine : (a) The speed of the turbine (b) The vane angle at outlet of the runner, and (c) Hydraulic efficiency.	**10**	**CO5**
	(B) Derive an expression for the work done by the runner of hydraulic turbine.	**10**	**CO2**