UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Program: B Tech / Mechatronics   **Semester –   V**

Subject   : Fluid mechanics and machinery   **Max. Marks : 100**

Course Code: GNEG 321   **Duration   : 3 Hrs**

No. of page/s: 3

Instructions:

SECTION A			
S. No.		**Marks**	**CO**
Q 1	Define manometric efficiency, volumetric efficiency, mechanical efficiency and overall efficiency in context of centrifugal pump.	**5**	**CO1**
Q 2	Discuss about the fluidic sensors and its working principle.	**5**	**CO4**
Q 3	Explain that the streamlines and equipotential lines form a net of mutually perpendicular lines.	**5**	**CO2**
Q 4	Define the term specific speed in context of turbine and state the permissible range for Pelton, Francis and Kaplan turbine.	**5**	**CO3**
SECTION B			
Q 5	Several flat plates are mounted on a wheel such that one of the plates is always in front of the jet. Show that the maximum efficiency attainable is 50%.	**10**	**CO2**
Q 6	Discuss about the design aspects of Pelton wheel on the basis of parameters like jet velocity, blade velocity, jet ratio, runner diameter, bucket dimensions, bucket size etc.	**10**	**CO1 &CO3**

	OR
	
	Draw a general layout of a hydraulic turbine power plant and explain the following terms.
	
	  a) Gross Head b) Net Head
	  c) Hydraulic efficiency d) Overall efficiency of the impulse turbine		

Q 7	a) A double runner Pelton wheel is to operate at 30,000 kW generator under an effective head of 300 m at the base of the nozzle. Find the size of jet, mean diameter of runner, speed of turbine and specific speed of each wheel. Assume generator efficiency 93%, Pelton wheel efficiency 85%, coefficient of nozzle velocity 0.97, speed ratio 0.46 and jet ratio to be 12.	10	CO4
Q 8	Determine the overall efficiency of a Kaplan turbine developing 5000 kW under a head of 10 m. It is provided with a draft tube with its inlet diameter equal to 3.2 m and set 2 m above the tailrace. A vacuum gauge connected to the draft tube indicates a reading of 6 m of water. Assume the draft tube efficiency 80 % with a head loss 1.2 m. The vapor pressure of water at 25 degree centigrade is 2.4m. Write your review on the use of this draft tube.	10	CO4
	SECTION-C		
Q 9	A centrifugal pump impeller having external diameter equal to 0.6 m. The ratio of internal to external diameter is 1:2. The rate of flow through pump is 60 liter/s with a velocity of flow constant at inlet and outlet with a magnitude of 2.4 m/s. The suction and delivery pipe diameters are 0.2m and 0.15 m respectively. The impeller rotates at 1200 rpm with suction and delivery heads equal to 6m (abs) and 30m. If the power required is 24 kW and the outlet vane angle is 40 degree, determine: (i) Inlet vane angle, (ii) overall efficiency and (iii) manometric efficiency of the pump. OR A single stage centrifugal pump runs at 600 rpm and delivers 360 m^3/min of water	20	CO3

	against a head of 144 m. The pump impeller is 2.4 m in diameter and it has a positive suction lift (including the velocity head and friction) of 3.6 m. Laboratory tests are to be conducted on a model with 0.54 m diameter impeller and on a reduced head of 114m . Calculate the speed, discharge and suction lift for the laboratory tests. Assume atmospheric head 10.18m of water and vapour head is 0.32m of water.		
Q 10.	The following data is given for an inward flow reaction turbine: Net head (H) = 85.4m, speed of runner (N) = 650 r.p.m., shaft power (P) = 397 KW, width of blade and diameter at inlet (B_1/D_1) = 0.1, outer diameter to inner diameter ratio = 0.5, flow ratio = 0.17, constant flow velocity and radial discharge. The overall efficiency and hydraulic efficiency are 0.85 and 0.95 respectively. Find the discharge, diameter and width at inlet and outlet of runner, velocity of whirl at inlet, inlet jet angle, and blade angle at inlet and outlet.	20	CO3