UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: Hydraulic Machines (PSEG242) **Semester: IV**
Program: PSE
Time: 03 hrs. **Max. Marks: 100**

Instructions: Assume suitable data, if required

SECTION A

S. No.		Marks	CO
Q 1	Describe the function of the diffuser in a centrifugal pump.	**4**	**CO3**
Q2	Explain the working principle of the Kaplan turbine with neat sketch.	**4**	**CO2**
Q3.	Define NPSH. Explain the cavitation phenomena in the pump.	**4**	**CO3**
Q4.	Explain working of reciprocating compressor.	**4**	**CO5**
Q5.	Explain simple hydraulic accumulator.	**4**	**CO4**
	SECTION B		
Q 6.	The Pelton wheel has a diameter of 3m and bucket deflection angle of 160^0. If the diameter of the water jet striking the wheel is 150 mm and the velocity of the jet is 8m/s, determine the power developed by the wheel when it is rotating 3rad/s.	**10**	**CO2**
Q7.	A turbine for the dam operates under a hydraulic head of 90m, producing a discharge of $50m^3/s$, If the reservoir level drops so that the hydraulic head becomes 60m, determine the discharge from the turbine.	**10**	**CO2**
Q8	Derive an expression for the force exerted by the jet of water on a fixed vertical plan in the reaction of the jet.	**10**	**CO1**
Q9.	Write short notes on the hydraulic lift and hydraulic ram OR Write short note on hydraulic press and torque converter.	**10**	**CO4**
	SECTION-C		
Q 10 a.	The plunger diameter and stroke length of a single acting reciprocating pump are 300mm and 500mm respectively. The speed of the pump is 50 rpm. The diameter and length of the delivery pipe are 150mm and 55mm respectively. If the pump is equipped with an air vessel on the delivery side at the centre line of the pump, find the power saved in overcoming friction in the delivery pipe. Take coefficient of friction f= 0.01	**20**	**CO3**
b.	A centrifugal pump is required to discharge 0.2 m^3 of water per second against a head of 22m when the impeller rotates at a speed of 1500rpm. The manometric efficiency is 75%. The loss of head in pump in meters due to fluid resistance is $0.03V_2^2$ where V_2 m/s is the velocity of water leaving the impeller. The area of the		

	impeller outlet surface is 1.2 D_2^2 m^2, where D_2 is the impeller diameter in metres. determine; 1. Impeller diameter. 2. The outlet vane angle Assume that the water enters the impeller without whirl. OR The piston diameter and stroke length of a double acting single cylinder reciprocating pump are 150mm and 300mm respectively. The centre of the pump is 4.5m above the water level in the sump and 32 m below the delivery water level. Both suction and delivery pipes have the same diameter of 75 mm and are 6m and 36 m long respectively. If the pump is working at 30 rpm. Determine; I. The pressure heads on the piston at the beginning, middle and end of the both suction and delivery stroke, II. The power required to drive pump if the mechanical efficiency is 80%. III. The maximum head at any instant against which the pump has to work and its corresponding duty. Take atmospheric pressure head = 10.3 m of water Coefficient of friction 0.01 for both the pipes.		
Q11. a. b. c.	Classify the compressors. Derive expression for the power required to drive the centrifugal compressor. A centrifugal compressor delivers 50 kg of air per minute at a pressure of 2 bar and 97^0C. The intake pressure and temperature of the air is 1 bar and 15^0C. if no heat is lost to the surrounding, find: 1. Index of compression 2. Power required if compression is isothermal.	**(5+8+7)**	**CO5**