

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), April-May 2016

B. Tech in Mechanical Engineering, Semester IV

Roll No.....

ME406: Hydraulic Machines

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
I.	Jet ratio is defined as (a) D/d (b) d/D (c) U/V_1 (d) None	
II.	A turbine is a device which converts (a) Hydraulic into mechanical (b) Mechanical into hydraulic (c) Kinetic into mechanical (d) Electrical into mechanical	
III.	The speed ratio for Pelton wheel varies from (a) 0.45 to 0.5 (b) 0.6 to 0.7 (c) 0.3 to 0.4 (d) 0.8 to 0.9	
IV.	Higher specific speed (300 to 1000) of turbine indicates that turbine is (a) Pelton wheel (b) Kaplan (c) Francis (d) All of the above	
V.	Impulse turbines are used for (a) Low head and low discharge (b) Low head and high discharge (c) High head and low discharge (d) High head and high discharge	
VI.	Kaplan turbine is which of the following type of turbine (a) impulse (b) radial flow impulse (c) axial flow reaction (d) reaction radial flow	
VII.	Air vessel are used in reciprocating pumps in order to (a) increase the delivery head (b) reduce the suction head (c) minimize delivery head fluctuation (d) reduce accelerating head	
VIII.	The example of impulse type of turbine is (a) Pelton wheel (b) Francis (c) Kaplan (d) All of the above	
IX.	The function of a pump is to convert energy (a) Hydraulic into mechanical (b) Mechanical into hydraulic (c) Kinetic into mechanical (d) Electrical into mechanical	
X.	Which one of the following pumps is not a positive displacement pump? (a) Lobe pump (b) Vane pump (c) Centrifugal pump (d) Reciprocating pump	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	A jet of water strikes a fixed flat plate with a velocity V , which is inclined at θ to the jet direction. Find out the force acting normal to the plate.	
ii.	What do you mean by the slip of a reciprocating pump?	
iii.	Give a schematic of hydro-electric power plant.	
iv.	How does a torque converter differ from a fluid coupling?	



Q.3A	Explain and derive Impulse momentum equation.	05
Q.3B	A jet of water of 5 cm diameter with a velocity of 20 m/sec strikes a fixed plate in such a way that the angle between the jet and the pipe is 60° . Find the force exerted by the jet on the plate: (i) in the direction normal to the plate (ii) in the direction of the jet.	05
Q.4A	Derive an expression for maximum efficiency of the Pelton wheel giving the relationship between the jet speed and bucket speed.	05
Q.4B	Design a Pelton wheel with the following data Shaft power = 11772 kW, Head = 380 m, Speed = 750 rpm, Overall efficiency 86 %, $D/d = 6$, $C_v = 0.985$, $\phi = 0.45$ Determine D, d and no of jets.	05
Q.5A	Explain the different types of the efficiency of a turbine.	05
Q.5B	A Kaplan turbine runner is to be designed to develop 10 MW shaft power. The net available head is 18 m. Assume the speed ratio is 2 and flow ratio is 0.7, The hydraulic efficiency 93% and the overall efficiency 82%. The diameter of the boss is $1/3$ rd of the diameter of the runner. Find the diameter of the runner and its speed.	05
Q.6A	How will you classify the Hydraulic pumps? Explain in detail.	05
Q.6B	Design a centrifugal pump impeller for the following conditions. Speed 800 RPM, Head 8 m, hydraulic efficiency 88%, overall efficiency 80%, shaft input 20 kW, peripheral coefficient 1.15, ratio of inlet to outlet dia 0.6, ratio of width to dia at outlet 0.15, flow area blocked by vanes 6%, fluid to be pumped - Gasoline of specific gravity 0.8.	10
Q.7A	Describe the principle and working of the air vessel for reciprocating pumps.	05
Q.7B	A double acting reciprocating pump, running at 50 rpm, delivers 8.4 liters/s of water. The dia of piston is 150 mm and stroke length 300 mm. the static head of the pump is 25 m. the suction pipe is 5 m long and 100 mm in diameter. Find the percentage slip and power required to run the pump. Also calculate the acceleration head at the beginning of the suction stroke.	10
	OR	
Q.7B	What is the effect of acceleration of the piston on the velocity and acceleration of the water in suction and delivery pipes? Obtain an expression for the pressure head due to acceleration in the suction and delivery pipes.	10
Q.8A	Explain the principle and working of a hydraulic Ram with a neat sketch.	10
Q.8B	Draw a neat sketch and explain the principle and working of a hydraulic press.	10
	OR	
Q.8B	Draw a neat sketch and explain the principle and working of a torque converter.	10

