



JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), April-May 2015

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.	A Pump is a device which converts (a) Hydraulic into mechanical (b) Mechanical into hydraulic (c) Kinetic into mechanical (d) Electrical into mechanical	
ii.	Pelton wheel is which of the following type of turbine (a) impulse (b) radial flow impulse (c) axial flow reaction (d) reaction radial flow	
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.	Specific speed of a turbine is defined as the speed of the turbine which produces? (a) unit power at unit head (b) unit power at unit discharge (c) unit discharge at unit head (d) unit discharge at unit power	
v.	Higher specific speed (300 to 1000) of turbine indicates that turbine is (a) Pelton wheel (b) Kaplan (c) Francis (d) All of the above	
vi.	Reaction 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	
vii.	Which of the following water turbines does not require a draft tube? (a) Propeller Turbine (b) Pelton Turbine (c) Kaplan Turbine (d) Francis Turbine	
viii.	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	
ix.	In axial flow turbine (a) Inlet is axial outlet is radial (b) Inlet is axial outlet is axial (c) Inlet is radial outlet is axial (d) Inlet is radial outlet is radial	
x.	Example of reaction radial flow type of turbine is (a) Pelton wheel (b) Francis turbine (c) Kaplan turbine (d) None of these	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	What is meant by the speed ratio of a Pelton wheel?	
ii.	Differentiate between the turbines and pumps.	
iii.	Give a schematic of hydro-electric power plant.	
iv.	What do you mean by Hydraulic Ram?	



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	Describe briefly the functions of various main components of Pelton turbine.	05
Q.4B	A Pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 lit/s under a head of 30 m. the buckets deflect the jet through an angle of 160° . Calculate the power given by water to the runner. $C_v = 0.98$	05
Q.5A	Derive an expression for specific speed of a turbine.	05
Q.5B	An inward flow reaction turbine has external and internal diameters as 1 m and 0.5 m respectively. The velocity of flow through the runner is constant and is equal to 1.5 m/s. Determine (i) Discharge through the runner, and (ii) Width of the turbine at outlet if the width of the turbine at inlet=200mm	05
Q.6A	What is a draft tube? What are its functions?	05
Q.6B	A Kaplan turbine runner is to be designed to develop 7357.5 kW shaft power. The net available head is 5.5 m. Assume the speed ratio is 2.09 and flow ratio is 0.68, and the overall efficiency is 60%. The diameter of the boss is $1/3^{rd}$ of the diameter of the runner. Find the diameter of the runner and its speed.	10
	OR	
Q.6B	A water turbine has a velocity of 6 m/s at the entrance to the draft tube and a velocity of 1.2 m/s at the exit. For friction losses of 0.1 m and tail water 5 m below the entrance to the draft tube, find the pressure head at the entrance.	10
Q.7A	Obtain an expression for unit speed, unit discharge and unit power for a turbine.	05
Q.7B	A Pelton wheel is revolving at a speed of 190 rpm and develops 5150.25 KW when working under a head of 220 m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio for the turbine is given as 0.47. Find the speed, discharge and power when this turbine is working under a head of 140 m.	10
	OR	
Q.7B	What is an air vessel? Describe the principle and working of the air vessel for reciprocating pumps.	10
Q.8A	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.8B	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.8B	Draw a neat sketch and explain the principle and working of a hydraulic press.	10