

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

EndTerm Examination (Regular/Backlog), April-May2015

B. Tech in Mechanical Engineering, Semester VI



Roll No.....

ME 603 : Hydraulic Machines

Time: 3 hours

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	(10 questions @ 1 mark)	10
i.	Power required to drive a centrifugal pump is directly proportional to... (i) dia (ii) dia ² (iii) dia ³ (iv) dia ⁴	
ii.	The mechanical efficiency of an impulse turbine is ...	
iii.	What is overshot water wheel?	
iv.	Discharge of a centrifugal pump is.... of its impeller. (i) directly proportional to dia (ii) inversely proportional to dia (iii) directly proportional to (dia) ² (iv) inversely proportional to (dia) ²	
v.	The static head of a centrifugal pump is equal to...	
vi.	Geometric similarity is said to exist if...	
vii.	The draft tube is used to, in a reaction turbine, ...	
viii.	The efficiency of centrifugal pump will be maximum when the blades are bent backward. (True/False)	
ix.	Efficiency of a Pelton wheel working under constant head with the increase in power. (i) remains same (ii) increases (iii) decreases (iv) insufficient info	
x.	What will happen if there is an air bubble in the brake lines of your car?	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	Explain air vessel.	
ii.	Why smaller diameter impeller is a better choice in spite of its lower efficiency?	
iii.	Cavitation in pumps? How it can be avoided?	
iv.	If for a purpose, one large mechanical and one large hydraulic system is built with same capacity and mechanical advantage. Then what will be the pros and cons of these two systems for a similar work?	
Q.3A	The aerodynamic drag of a new sports car is to be predicted at a speed of 80.0 km/hr at an air temperature of 25°C. Engineers built a 1/5 scale model of the car to test in a wind tunnel. The temperature of the wind tunnel air is 5°C. Determine how fast the engineers should run wind tunnel in order to achieve similarity between the model and prototype.	05

Q.3B	Einstein is pondering how to write his equation. He knows that energy is a function of mass and speed of light but he doesn't know the exact relationship. Now, as you know the dimensional analysis, you got to help him to reach to desired result assuming Einstein knows nothing about dimensional analysis☺.	05
Q.4A	Derive the expression of slip and efficiency for the fluid coupling.	05
Q.4B	The water is supplied at the rate of 3000 lpm from a height of 4m to a hydraulic ram which raises it to 300 lpm to a height of 30 m from the ram. The length and dia of delivery pipe is 100m and 70mm respectively. Calculate the efficiency of hydraulic ram if $f=0.009$.	05
Q.5A	show that the power P developed in a hydraulic turbine can be expressed as:	10
	$P = \rho \cdot N^3 \cdot D^5 \cdot \varphi \left\{ \frac{D}{B}, \frac{\rho D^3 N}{\mu}, \frac{ND}{\sqrt{gH}} \right\}$	
	Where all the notations have their usual meanings.	
Q.6A	Give constructional details of Pelton wheel turbine. Draw neat diagrams.	05
Q.6B	Draw a neat and clean diagram of hydraulic crane.	05
	OR	
Q.6B	Explain working of hydraulic accumulator with diagram.	05
Q.7A	Explain similitude and the types of similarities.	05
Q.7B	Give constructional details of modern Francis turbine.	05
	OR	
Q.7B	Write details about draft tube for a reaction turbine.	05
Q.8A	On the basis of your knowledge of hydraulic systems and fluid mechanics, design a system to give a feasible solution to a practical problem which you think still persists in society and no other inventor except you has given a thought about it.	10
Q.9A	Explain different efficiency ratings of a centrifugal pump. Explain slip factor. a centrifugal pump is required to deliver 50 liters of water per second to a height of 30m through a 100m long pipe of 15cm dia. The inlet losses in the suction pipe are estimated to be 0.35m. Assuming an overall efficiency of 70% and taking friction factor = 0.015 for the pipeline, determine power required to drive the pump.	3+2 +5
Q.9B	A jet of water having a velocity of 45m/s impinging without shock on a series of vanes. The direction of motion of vanes is inclined at 20° to that of the jet, the relative velocity at outlet is 0.9 of that at inlet and the absolute velocity of the water at exit is to be normal to the motion of vanes find (i) vane angles at entrance and exit; (ii) work done on vanes per kg of water supplied by the jet (iii) hydraulic efficiency.	10
	OR	
Q.9B	find the expression for maximum efficiency when jet strikes at the centre of a moving vane (i) single vane (ii) series of vanes	10

