P P SAVANI UNIVERSITY

Fifth Semester of B. Tech. Examination
December 2021
SEME 3021 Fluid Machines

06.12.2021, Monday   Time: 09:00 a.m. To 11:30 a.m.   Maximum Marks: 60

Instructions:
1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1	Answer the Following:	[05]
(i)	What is a Fluid System?	
(ii)	What is the function of Air Vessels?	
(iii)	Give the function of Hydraulic Accumulator.	
(iv)	What is Priming?	
(v)	Define the Impact of Jets.	

Q - 2 (a)	What is cavitation? What are its causes? How it can be prevented in centrifugal pump.	[05]
Q - 2 (b)	Explain with the help of a neat sketch the principle and operation of hydraulic accumulator.	[05]

OR

Q - 2 (a)	A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find:	[05]
	(i) The force on the plate,	
	(ii) the work done, and	
	the efficiency of jet.	
Q - 2 (b)	Compare Reciprocating pump with Centrifugal pump. Draw theoretical indicator diagram of reciprocating pump.	[05]
Q - 3 (a)	Find the power required to drive a centrifugal pump which delivers 0.04 m³/s of water to a height of 20 m through a 15 cm diameter pipe and 100 m long. the overall efficiency of the pump is 70 % and coefficient of friction f = 0.015. [Use formula $h_f = (4fLV^2)/(2gd)$]	[05]
Q - 3 (b)	Explain following terms related to centrifugal pump : (i) Suction head (hs) (ii) Delivery Head (hd) (iii) Manometric Head (Hm) (iv) Manometric Efficiency (v) Multi stage	[05]

OR

Q - 3 (a)	Write a short note on : hydraulic ram.	[05]
Q - 3 (b)	Derive an Expression for (i) Force Exerted by a Jet on Stationary Vertical Plate (ii) Force Exerted by a Jet on Flat Vertical Plate Moving in the Direction of Jet.	[05]
Q - 4	Attempt any one.	[05]
(i)	Derive an Expression for Specific Speed for a Centrifugal Pump.	
(ii)	Give classification of reciprocating pumps and explain slip of reciprocating pump.	

SECTION – II

Q - 1 Answer the Following: (Fill in the Blanks: Any five) [05]

(i) Equation of continuity results from the principal of conservation of _____

(ii) In equation H = H_g (gross head) – h_f (head loss due to friction), then H represents _____

(iii) The ratio of actual work available at the turbine to the energy imparted to the wheel is known as _____ efficiency.

(iv) The efficiency of a centrifugal pump will be maximum if the blades are bent _____
    a. Backward
    b. Forward
    c. Straight
    d. inclined

(v) Work done by a turbine _____ upon the weight of water flowing per second
    a. depends
    b. does not depend

(vi) The principle of jet propulsion is used in driving the ships and aero-planes.
    a. Correct
    b. Incorrect

(vii) In the casing of centrifugal pump, the kinetic energy of water is converted into pressure energy before the water leaves the casing.
    a. True
    b. False

Q - 2 (a) Briefly explain about the working of pelton turbine. Also, explain about the main parts of pelton turbine. [05]

Q - 2 (b) What do you mean by gross head, net head and efficiency of turbine? Explain the different types of the efficiency of a turbine. [05]

OR

Q - 2 (a) What are the difference between centrifugal pump and reciprocating pump. [05]

Q - 2 (b) Define specific speed of a turbine? What is the significance of the specific speed? [05]

Q - 3 (a) What is streamline flow? How streamline flow is different from vortex flow? [05]

Q - 3 (b) Derive an expression for the force exerted by a jet on stationary inclined flat plate. [05]

OR

Q - 3 (a) Derive and expression for the force exerted by a jet on a flat vertical plate moving in the direction of jet. [05]

Q - 3 (b) A jet of water of diameter 10 cm strikes a flat plate normally with a velocity of 15 m/s. The plate is moving with a velocity of 6 m/s in the direction of the jet and away from the jet. Find: [05]
    i. the force exerted by the jet on the plate.
Work done by the jet on the plate per second

Q - 4 Attempt any one. [05]

(i) A reaction turbine works at 450 rpm under a head of 120 metres. Its diameter at inlet is 120 cm and the flow area is 0.4 m². The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine:
    i. The volume flow rate
    ii. The power developed
    iii. Hydraulic efficiency
Assume whirl at outlet to be zero.

(ii) What is the basis of selection of a turbine at a particular place?

****