Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016

Subject Code:2151903 Date:19/11/2016

Subject Name:Fluid Power Engineering

Time:10:30 AM to 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 Short Questions **14**

1 The force of impingement of a jet on a vane increases if:
(a) the vane angle is increased
(b) the vane angle is decreased
(c) the pressure is reduced
(d) the vane is moved against the jet.

2 Which one of the following is an example of a pure (100%) reaction machine?
(a) Pelton wheel, (b) Francis turbine
(c) Modern gas turbine, (d) Lawn sprinkler

3 In the case of Francis turbine, velocity ratio is defined as $V_3 / 2gh$. where H is the available head and V_3 is the
(a) absolute velocity at the draft tube inlet
(b) mean velocity of flow in the turbine
(c) absolute velocity at the guide vane inlet
(d) flow velocity at the rotor inlet

4 Kaplan turbine is
(a) a high head mixed flow turbine
(b) a low axial flow turbine
(c) an outward flow reaction turbine
(d) an impulse inward flow turbine

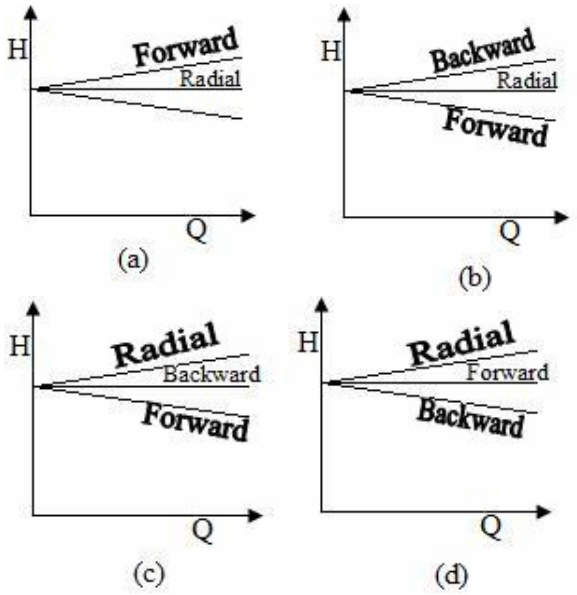
5 Which one of the following is not correct regarding both Kaplan and propeller turbines?
(a) The runner is axial
(b) The blades are wing type
(c) There are four to eight blades
(d) The blades can be adjusted

6 What is the purpose of a surge tank in high head hydroelectric plants?
(a) To prevent water hammer due to sudden load changes
(b) To improve the hydraulic efficiency
(c) To prevent surges in generator shaft speed
(d) To act as a temporary storage during load changes

7 In hydraulic power-generation systems, surge tanks are provided to prevent immediate damage to
(a) draft tube (b) turbine (c) tail race (d) penstocks

8 Manometric efficiency of a centrifugal pump is defined as the ratio of (a) Suction head to the head imparted by the impeller to water, (b) head imparted by the impeller to water to the suction head, (c) manometric head to the head imparted by the impeller to water, (d) head imparted by the impeller to water to the manometric head

9 Which one of the following figures represents theoretical head versus discharge curves for a centrifugal pump with forward radial and backward curved vanes?



10 Which one of the following helps in avoiding cavitation in centrifugal pumps?
(a) Low suction pressure (b) High delivery pressure
(c) Low delivery pressure (d) High suction pressure

11 hydraulic coupling belongs to the category of
(a) power absorbing machines
(b) power developing machines
(c) energy transfer machines
(d) energy generating machines

12 To carry water under pressure from large reservoir to turbine is a function of
(a) Spill way (b) Penstock (c) Draft tube (d) Tail race

13 The Bernoulli's equation refers to conservation of
(a) Mass (b) linear momentum (c) energy (d) angular momentum

14 Cavitation in a hydraulic turbine is most likely to occur at the turbine
(a) entry (b) rotor exit (c) stator exit (d) all of above

Q.2 **(a)** Sketch the layout of hydroelectric power plant (HEPP) with proper nomenclature. **03**

(b) List out important hydroelectric power plant installation in Gujarat. Also give advantages and disadvantages of HEPP. **04**

(c) The power to be generated by a hydroelectric power plant is 3000kW under the available head of 40 m and the turbine has to run at 250rpm. Calculate number of turbine units required when (a) the multi jets Pelton wheel is used with maximum specific speed 60 units, (b) **07**

Kaplan turbine is used with maximum specific speed 600 units and (c) Francis turbine is used with specific speed 200 units.

OR

	(c)	A rectangular plate weighing 80 N, suspended vertically on the top of horizontal edge. The center of gravity of plate is 8 cm from the hinge. A jet of water coming out of nozzle of 2.5 cm diameter strikes the plate 12 cm below the hinge with a velocity 8m/s. Determine (1) horizontal force required to be applied at CG for maintaining the plate in its original position, (2) inclination of the plate with vertical if the plate is allowed to swing freely.	**07**
Q.3	**(a)**	A jet of water 10 cm diameter impinges normally on a fixed vertical plate with a velocity of 25 m/s. Calculate force exerted on the plate.	**03**
	(b)	Derive expressions for work done for impact of jet on a moving inclined plate.	**04**
	(c)	Explain principle of jet propulsion.	**07**

OR

Q.3	**(a)**	Define – (a) Hydraulic Turbine, (b) Hydraulic machines.	**03**
	(b)	Explain impulse turbine with neat sketch.	**04**
	(c)	A hydroelectric power plat developing 80MW brake power under the head 450m and at 450 rpm, determine (a) total quantity of water required, (b) diameter of jet, dimeter of runner, (c) no. of nozzle required, (d) no. of buckets in runner. Assuming overall efficiency. Take η_0=90%, jet ratio $\frac{D}{d}$ = 10, co-efficient of velocity C_V=0.97 and speed ratio = 0.46.	**07**
Q.4	**(a)**	What is pump? Classify Pumps.	**03**
	(b)	Draw characteristics curves of centrifugal pump. Explain briefly.	**04**
	(c)	Write down difference between Positive displacement pumps and Rotodynamic pumps.	**07**

OR

Q.4	**(a)**	What is mud pump? Write its applications.	**03**
	(b)	Explain submersible pump with advantages and disadvantages.	**04**
	(c)	The inner and outer diameters of an impeller of a centrifugal pump are 0.2m and 0.4m respectively. The vane angle and velocity of flow at outlet are 60°and 1.4 m/s respectively. Determine minimum speed required to start the flow if manometric efficiency is 76%.	**07**
Q.5	**(a)**	State the advantages of scroll compressor.	**03**
	(b)	Compare reciprocating compressor with centrifugal compressor.	**04**
	(c)	Explain phenomenon of surging and stalling in an axial flow compressor with neat sketch.	**07**

OR

Q.5	**(a)**	If a hydraulic press has a ram of 12.5 cm diameter and plunger of 1.25 cm diameter, calculate force required on the plunger to raise a mass of 1 tonne on the ram?	**03**
	(b)	Write down comparison between Fluid coupling and Fluid torque converter.	**04**
	(c)	Write a note on – "Hydraulic intensifier".	**07**

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