Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 711205N **Date: 05-12-2014**

Subject Name: Hydro Power Engineering

Time: 10:30 am - 01:00 pm **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	Explain the following i) Plant Load Factor ii) Secondary Power iii) Diversity Factor iv) Pondage Factor	**07**
	(b)	Write short notes:- i) Trashrack ii) Non-conventional Energy sources	**07**
Q.2	**(a)**	Define Power house & list its components. Discuss the typical layout of a power house.	**07**
	(b)	Discuss the classification of hydropower plant.	**07**
		OR	
	(b)	Compare the suitability and limitations of storage power development and run-of river power development.	**07**
Q.3	**(a)**	Explain the classification of penstocks.	**07**
	(b)	The load on a hydel plant varies from a minimum of 14000 HP to a maximum of 50000 HP. The turbo generators of capacities 25000 KW each have been installed. Calculate i) total installed capacity of the plant ii) Plant Capacity Factor iii) Load Factor iv) Utilization Factor	**07**
		OR	
Q.3	**(a)**	List out and explain briefly the factors governing the layout of penstocks.	**07**
	(b)	A hydroelectric station is to be supplied with a 20 m^3/s of water through a penstock which has a friction factor of 0.015. The maximum normal head on the penstock is 60 Kg/cm^2 and a water hammer overpressure of 15% over the normal pressure is anticipated. The safe stress in the steel used is presumed to be 3500 Kg/cm^2. The ready penstocks at site are likely to cost Rs. 12000 per tonne including erection charges. It is proposed to sell the energy at the rate of Rs. 0.05 per KWH. What should be the optimum diameter of the penstock, given that the OMR costs are 7 per cent? Assume turbine efficiency to be 85 per cent and the annual load factor as 0.45. Take Capital Recovery Factor as 0.0815.	**07**
Q.4	**(a)**	Explain the significance of surge tanks in hydropower plant. Discuss various type s of surge tank.	**07**
	(b)	Discuss various factors affecting location of Intake.	**07**
		OR	
Q.4	**(a)**	Explain the phenomenon & significance of water hammer studies. Briefly explain rigid and elastic water column theories.	**07**
	(b)	Discuss function and nature of energy losses in Intake with their relative contribution in total head losses.	**07**
Q.5	**(a)**	Classify the various turbines used in hydropower development.	**07**

(b) At some hydroelectric plant the Kaplan turbine used has the following data:- **07**

Operation head=25 m
Output power at this head= 125 MW
Discharge at this head= 625 m^3/s
Speed=70 RPM
Runner tip-to-tip diameter, D= 9.5 m
Hub diameter= 4.5 m
Number of blades= 7
Calculate the speed ratio, the flow ratio and the overall efficiency and the maximum suction draft head. Take $h_b - h_v = 10.0$ m

OR

Q.5 **(a)** Discuss the various types of Gates and Valves. **07**

(b) Describe the process of selection of turbines. Compare the turbines giving sketch of their characteristic curves. **07**

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