Form A: Paper-setting Blank Ref. No. EX/PE/T/324/2019

B. Power Engineering 3rd yr. 2nd Sem Examination, 2019

Subject: **Hydro Power Generation**

Time: Three hours Full marks: 100

Answer any Five Questions

No. of questions		Marks
1	Why surge tanks are essential for long penstocks? What is meant by economical diameter of a penstock? Discuss the different types of surge tanks. Why losses in the bulb turbines are less compared to other types of turbines? Draw and compare the performance curves for various types of hydraulic turbine..	4+3+5+2+6
2.	What is meant by hydrological cycle? How can the parameters of the cycle be written in an equation form? What are advantages of diagonal flow turbines? What do you mean by a mass curve of runoff?	5+3+8+4
3.	Rated head of a hydro electric power plant is 75m. The plant is on a canal and the discharge from the dam is totally controlled by the irrigation department. The water released from the dam during the 12 months is given below. Draw the power duration curve. Given discharge in cumec. Jan 1.15, Feb 0.0, March 0.58, April 8.17, May 24.6, June 17.1, July 7.9, Aug 11.3, Sept 10.7, Oct 4.9, Nov 0.02, Dec 0.0 Why anchor blocks are used for long penstocks? Based on what criteria penstocks are selected?	14+3+3
4.	With neat diagram show the different loads considered while designing a dam. What is meant by buttress dam? Discuss its types. A Kaplan turbine runs under a head of 22.5m gives an output of 126MW while discharging 615m3/s of water. The turbine runs at 68.2rpm. The runner has 6 blades and the runner tip-to-tip diameter is 9.3m with hub diameter as 4.3m. Calculate the speed ratio, the flow ratio, overall efficiency and specific speed of the machine.	4+4+12
5.	The rated installed capacity of generator of a run-of-river plant is 10,000kW under operated head of 15m with plant efficiency of 80%. The plant operates as a peak load station with a weekly load factor of 20%, all its capacity is firm capacity. What will be the minimum flow in the river so that the station may serve as the base load station? Also find the daily load factor of the plant for stream flow of $15m^3/s$. How can you determine the storage capacity of a reservoir with the help of a constant or variable demand?	16+4

	6.	A 4 jet vertical shaft Pelton turbine is to be coupled to a 70000kVA, 3 phase, 50 Hz generator. The generator is provided with 10 pairs of poles. The transmission efficiency of headrace tunnel and penstock together is 94%. If the total power output of the machine is 348000hp at a guaranteed efficiency of 91% find the discharge of the plant and specific speed of the turbine. Discuss the different types of embankment dams.	14+6
	7.	A catchment area is divided into four sub-basins. The rainfall data recorded by each sub-basins is given below. Calculate the average annual precipitation in cm over the catchment by (i) arithmetic average method and (ii) Theissen polygon method. For Thession polygon method the areas are estimated as 52 sq km, 77 sq km, 35 sq km and 68 sq km respectively corresponding to the rain gauge station no. Show the Thession polygon method before calculating the precipitation using this method. Also calculate the error using arithmetic average method. St. no. 1 2 3 4 Average rainfall(mm) 124 114 126 99 What is hydrograph? Discuss its different limbs with a neat sketch.	12+8
	8.	What are advantages of diagonal flow turbines? The pressure tunnel length of a hydro power plant is 10km with a cross-section of $10m^2$. The flow velocity within the tunnel is 2m/s. The cross-section of the cylindrical surge tank is 100 m^2. Compute the maximum surge height and the period of the oscillation assuming the ideal fluid for instantaneous closing of the tunnel. Find the velocity of flow of water in the tunnel for quarter period.	8+12