BE Power Engineering 3rd yr. 2nd Semester Examination, 2017

Subject: **Hydro Power Generation**

Time: Three hours   Full marks: 100

Answer any Five Questions

No. of questions		Marks
1	What is meant by hydrological cycle? How can the parameters of the cycle be written in an equation form? A square catchment area of 25 sq unit has five rain gauges installed. With respect to a Cartesian co-ordinate system the corner points of the area are (0,0), (0,5), (5,5) and (5,0) unit. The co-ordinates of the rain gauge stations are (1,1), (3,-1), (4.5,1.5), (3.5,3.5), (0.5,4) unit and the corresponding rainfall values are 6.5cm, 8.3cm, 12.7cm, 11.8cm and 5.0cm respectively. Calculate the average rainfall over the catchment area by (i) Arithmetical average method and (ii) Theissen polygon method.	2+2+16
2.	What do you understand by a mass curve of runoff? How can you determine the storage capacity of a reservoir with its help if a constant or a variable demand is know? For a SHP (2x1500kW) (rated discharge per unit is 5.974cumec) at Gujarat the inflow in the stream is recorded for 14 consecutive years as mentioned below:	2+4+14

year	1	2	3	4	5	6	7
Inflow (Mm^3)	602.74	810.62	1127.52	1676.14	628.1	739.37	927.05

year	8	9	10	11	12	13	14
Inflow (Mm^3)	925.9	398.54	294.4	864.54	765.86	1152.59	1359.95

No. of questions		Marks
	Draw the flow duration curve. The plant has efficiency of 82.3%, 78.27% and 72.62% at 100%, 80% and 60% of rated load respectively. Using FDC find the weighted efficiency of the plant.	
3.	What do you mean by co-efficient of variation of annual rainfall? What is hydrograph? Discuss its different limbs with a neat sketch. What are different methods for direct and indirect measurement of run-off? Given below are the monthly rainfall P and the corresponding runoff R values covering a period of 8 months for a catchment. Develop a correlation equation between R and P	3+4+3+10

Month	P	R	Month	P	R
1	5	0.5	5	15	3.1
2	35	10.0	6	10	3.2
3	40	13.8	7	5	0.1
4	30	8.2	8	31	12.0

No. of questions		Marks
4.	The cost of loss of energy due to friction in the penstock against various diameter at the prevalent rate of sale of energy is given below: Cost (x 10^4 Rs.): 7 5 3 0.7 0.2	20

Diameter (m):   0.6   1.2   2.4   4.5   5.5
The total annual maintenance cost of a penstock to various diameter is given below:
Cost (x 10^4 Rs.): 0.5 1.6   3.4   5.8
Diameter (m):   1.1   3.0   5.0   7.0
Find the optimum diameter of the penstock by graphical method.

5.	Why anchor blocks are used for long penstocks? Based on what criteria penstocks are selected? What are the different loads considered while designing a dam? Discuss with diagram only. Discuss the different types of embankment dams.	2+4+6+8
6.	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. Discuss in brief the graphical method for selection of optimum diameter of a penstock.	12+8
7.	What are different methods for the classification hydro power plants? What do you understand by run-of-river plants? What are the components and arrangements of such plants? Why surge tank is essential for long penstock? What do you mean by dead storage and live storage of a dam? What are the different methods used for the measurement of discharge while testing a hydro power plant?	5+2+2+3+2+6
8.	The data collected during performance testing of a Full Kaplan turbine based SHP (2x1.25MW) at different loads are tabulated below	20

Item/Load	100%	80%	60%	110%
Discharge (cumec)	22.31	16.816	12.37	23.141
Pressure at inlet (kg/cm^2)	0.43	0.49	0.527	0.42
Duration of test (minute)	30	15	15	10
Energy reading (Wh)	52.656	21.262	16.011	18.171
CTR	400A/1A			
VTR	3.3kV/110V			
TWL (right bank), m	2.858	3.065	3.177	3.050
TWL (left bank), m	2.362	2.577	2.699	2.563
Center line of Penstock (Bench mark): 426.50m above MSL				
Level of pressure transmitter diaphragm: 428.55m above MSL				
Elevation of ULS (left bank): 428.889m above MSL				
Elevation of ULS (Right bank): 429.411m above MSL				
Density of water: 997.0kg/m^3				
Accleration due to gravity: 9.781m/s^2				
Diamter of penstock where pressure transmitter is fitted: 3000mm				

Draw the efficiency curves verses percentage of load.