Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination – May 2018

Program/course: B. Tech ET+IPR | **Semester – VIII**
Subject: Hydro Power Generation | **Max. Marks : 100**
Code : PSEG 362 | **Duration : 3 Hrs**
No. of page/s: 2

Section A

All questions are mandatory: (Each question: 4 marks)

Q.no.	COs	Question
1.	CO1	Discuss the opportunities and threats of hydropower system.
2.	CO1	Explain how to evaluate the hydropower potential of a site.
3.	CO2	Classify the hydropower plant in terms of its capacity.
4.	CO3	"Direct intake design is comparatively better than side intake", Justify.
5.	CO4	Calculate specific speed, if the system has a head of 100m and if 850kW turbine is coupled to a generator of 1500rpm.

Section B

All questions are mandatory: (Each question: 10 marks)

Q.no.	COs	Question
6.	CO1	A 24-hour storm occurred over a catchment of 2.8 km^2 area and the total rainfall observed was 12 cm. An infiltration capacity curve prepared had the initial infiltration capacity of 1.5 cm/hr and attained a constant value of 0.7 cm/hr after 18 hours of rainfall with a Horton's constant k = 6 hr^{-1}. An IMD pan installed in the catchment indicated a decrease of 0.55 cm in the water level (after allowing for rainfall) during 24 hours of its operation. Other losses were found to be negligible. Determine the runoff from the catchment. Assume a pan coefficient of 0.72.
7.	CO2	Explain the working of the following in detail with neat diagram: a. Pumped storage plant [5M] b. Tidal power plant [5M]
8.	CO3	Explain different types of surge tanks with neat diagram.
9.	CO4	Koyna powerhouse is equipped with four units of vertical shaft Pelton turbines to be coupled with 70,000 kVA, 3 phase 50 Hz generators. The generators are provided with 10 poles. The gross design head is 505 m and the transmission efficiency of headrace tunnel and penstocks together is to be 94%. The four units together will provide power of 256000 kW at a guaranteed efficiency of 91%. The nozzle efficiency is 98% Calculate the following:

		Speed of the generator [3M] Net head [3M] The design discharge of the turbine [4M] Specific speed [4M]

Section C

All questions are mandatory: (Each question: 20 marks)

Q.no.	COs	Question
10.	CO1	The 3-hr unit hydrograph ordinates for a basin are given below. There was a storm, which commenced on July 15 at 16.00 hr and continued up to 22.00 hr, which was followed by another storm on July 16 at 4.00 hr which lasted up to 7.00 hr. It was noted from the mass curves of self-recording rain-gauge that the amount of rainfall on July 15 was 5.75 cm from 16.00 to 19.00 hr and 3.75 cm from 19.00 to 22.00 hr, and on July 16, 4.45 cm from 4.00 to 7.00 hr. Assuming an average loss of 0.25 cm/hr and 0.15 cm/hr for the two storms, respectively, and a constant base flow of 10 cumec, determine the stream flow hydrograph and state the timeof occurrence of peak flood. **Time (hr)** 0 3 6 9 12 15 18 21 24 27 **UGO (cumec)** 0 1.5 4.5 8.6 12 9.4 4.6 2.3 0.8 0 Plot hydrograph and unit hydrograph.
11.	CO3	a. Discuss the essential design factors to be considered during the planning stage of HPP. [10M] b. Explain the procedure for selection of penstock for hydro power plant. [10M] **(OR)** a. Explain why mid-length penstock layout is selected compared to short and long penstock layout. [10M] b. Explain the procedure for selection of best diameter and type of penstock. [10M]

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Section A

All questions are mandatory: (Each question: 4 marks)

Q.no.	COs	Question
1.	CO1	Discuss various head measurement techniques with neat diagram.
2.	CO1	Discuss the advantages of unit hydrograph method.
3.	CO2	Explain importance of plant utilization factor and load factor.
4.	CO3	Explain why silt basin is near to intake in small hydro power plant.
5.	CO4	Calculate specific speed, if the system has a head of 100m and if the discharge from the pump is 0.5 m^3/s and the speed of the motor is 1500rpm.

Section B

All questions are mandatory: (Each question: 10 marks)

Q.no.	COs	Question
6.	CO1	The infiltration capacity curve for a catchment having the initial infiltration capacity of 2.0 cm/h, which assumes almost a constant value of 0.5 cm/h after 9 hours of rainfall. Estimate the total infiltration, if the Horton's constant, k, is equal to 4 per day.
7.	CO2	Two stations share a common load; one being a base load plant with 20MW installed capacity and other being a standby with 25MW capacity. The yearly output of the standby is 12.5 x 10^6 kWh and that of the base load plant is 115 x 10^6 kW. The peak load taken by the standby is 15 MW working for 2570 hours during the year. The base load station takes a peak of 20.5 MW. Find the following: i. Annual load factors for both the stations [3M] ii. Plant use factors for both [4M] iii. Capacity factors for both [3M]
8.	CO3	Explain surge pressure and friction loss of hydro power plant with neat diagram.
9.	CO4	At the Volga imeni VI Lenin hydro-electric plant in Russia, the Kaplan turbine used has the following data: Operation head = 22.5m Output power at this head = 126 MW.

		Discharge at this head = $615m^3/s$. Speed = 68.2rpm. Diameter = 5m. Calculate the following: a. Average velocity [3M] b. Specific speed [4M] c. Overall efficiency [3M]

Section C

All questions are mandatory: (Each question: 20 marks)

Q.no.	COs	Question
10.	CO1	The design storm of a water shed has the depths of rainfall of 4.9 and 3.9 cm for the consecutive 1-hr periods. The 1-hr UG can be approximated by a triangle of base 6 hr with a peak of 50 cumec occurring after 2 hr from the beginning. Compute the flood hydrograph assuming an average loss rate of 9 mm/hr and constant base flow of 10 cumec. Calculate the area of water shed and its coefficient of runoff. Also, plot hydrograph and unit hydrograph.
11.	CO3	a. "Direct intake design is comparatively better than side intake", Justify. [10M] b. Explain the essential factors to be considered while designing silt-basin for high head plants. [10M] **(OR)** a. Explain in detail about intake protection with neat diagram also comment on its location in high head plants. [10M] b. Explain the factors to be considered for calculation of intake dimensions. [10M]