Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

Course: Small Hydro Power System **Semester: II**
Program: M. Tech REE **Time 03 hrs.**
Course Code: EPEC 7018 **Max. Marks: 100**

Instructions:

1. **Attempt all the questions (Theory, Numerical, Case study etc.) on A4 size blank sheets.**
2. **Attempt all questions serially as per question paper.**
3. **Answer should be neat and clean. Draw a free hand sketch for circuits/tables/schematics wherever required.**
4. **Scan the whole answer script and check the resolution carefully before you upload on the blackboard. Note that answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.**
5. **You are expected to be honest about each attempt which you make to progress in life**

SECTION A - 40 Marks

S. No.		Marks	CO
Q 1	In a regional power grid of a country the weekly load curve indicates the following: a. There is an energy shortage of 15 GWh per working day spread uniformly over 12 hours. b. There is a spare energy of 9 GWh per day spread over 3 hours uniformly. c. Demand is quite slack on Sundays so that enough energy can be spread for the pumps. Design wind and pumped storage plant based standalone - hybrid power system to satisfy above load curve. Month wise availability of renewable energy resources in the area is given below:	**20**	**CO4**

S.no	Month	Wind speed (m/s)
1	January	5.01
2	February	5.03
3	March	4.94
4	April	4.98

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hhrs from the scheduled time (*exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
No Submission will be entertained after 24 Hrs

		5	May	5.44
		6	June	5.37
		7	July	5.12
		8	August	4.98
		9	September	5.01
		10	October	5.19
		11	November	5.09
		12	December	5.18

Topology

There is a large reservoir on a big river to serve as lower pool. A suitable site is available 1.25 km away with a high hill 300 m higher than the lower pool for developing the above reservoir.

Assume the parameters wherever required.

Q 2	The average direct runoff calculated from hydrological studies allowed into the hydropower channel is 0.52 m^3/s. Given: Gross head = 284m. $L_{horizontal}$ = 1800 m. Roughness k = 0.18 mm. The turbulent losses $K_{entrance}$ = 1, K_{bend1} = 0.38, K_{bend2} = 0.38, K_{valve} = 0.1 E = 100 x 10^9 N/m^2 S = 140 x 10^6 N/m^2 Select the best penstock diameter and its thickness among the following: 1. Penstock diameter (d) = 0.45m; thickness = 0.165 * d 2. Penstock diameter (d) = 0.35m; thickness = 0.165 * d 3. Penstock diameter (d) = 0.30m; thickness = 0.165 * d	**20**	**CO2**
	SECTION B - 60 Marks		
Q 3	a. The rainfall data for a catchment is given below: **Time period in hours** | 0-2 | 2-4 | 4-6 | 6-8 | 8-10 | 10-12 | 12-14 | 14-16 **Rainfall in cm** | 5.5 | 3.5 | 10.0 | 5.0 | 3.0 | 0.0 | 8.0 | 3.5 Draw the rainfall hyetograph. If the Φ- index is 2.5 cm/h, calculate the runoff.	**5+5**	**CO1**

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	b. 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.		
Q 4	Explain different types of silt basin for small hydropower system based on its design.	**10**	**CO2**
Q 5	a. A 12kW micro hydro project for grain milling is proposed. It has a startup cost of Rs. 2000000. The discount rate is 20%. An energy survey relating to the project established that the grain milling operation would bring in annual earnings of Rs. 700000. The operating and maintenance cost are expected to be 14000 per year. What will be the income of the project, if the cost and earning are imagined as spread out over 12 years? b. Discuss briefly on cash flow analysis related to small hydropower system.	**5+5**	**CO4**
Q 6	a. A 100 MW reversible pump-turbine has to work under a head of 400m. Choose a suitable specific speed and running speed for the machine. Note: Assume the efficiency of machine as 88%. b. Explain the environmental impacts of hydro power plant with a capacity less than 25MW.	**5+5**	**CO5, CO6**
Q 7	Compare small, mini and micro hydro power plant.	**5**	**CO1**
Q 8	Readings taken with a float that is made to flow along a known length of 20m along a river with a smooth bed and sides; the width and depth of the river being 15m and 2m, respectively. Calculate the flow of the river if the time taken for the float to traverse 20m is 25 seconds. Assume the velocity correction factor as 0.85.	**5**	**CO2**
Q 9	Discuss different types of hydraulic turbines used in small hydropower system	**5**	**CO3**
Q 10	Discuss the potential of SHP in India	**5**	**CO4**

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