Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, June 2021

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

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: Write short / brief notes ; Use graph sheets to plot the graphs (if any)

S. No.		CO
Q 1	i. The shape of recession limb of a hydrograph depends upon a. Basin characteristics only b. Storm characteristics only c. Both (A) and (B) d. None of the above ii. The flow-mass curve is graphical representation of a. Cumulative discharge and time b. Discharge and percentage probability of flow being equaled or exceeded c. Cumulative discharge, volume and time in chronological order d. Discharge and time in chronological order iii. Interception losses are due to (i) Evaporation (ii) Transpiration (iii) Stream flow The correct answer is a. Only (i) b. (i) and (ii) c. (ii) and (iii) d. All (i), (ii) and (iii) iv. Evaporation losses depend upon a. Area of the water surface and depth of the water b. Nature of precipitation and type of vegetation c. Humidity and wind velocity d. All the above v. The runoff is affected by a. Size of the basin b. Shape of the basin c. Elevation of the water shed d. All the above	**CO 1**
Q 2	A hydro power plant is equipped with Pelton turbine generates 0.5 MW at a speed of 280 rpm. The gross head is 400 meters. Calculate the specific speed of the turbine.	**CO 2**
Q 3	i. Impulse turbine requires _____ head and _____ discharge. ii. Reaction turbine requires_____ head and _____ discharge. iii. Pelton turbine is _____ a. Tangential flow	**CO 2**

<table>
<tr><td></td><td>b. Radial flow
c. Axial flow
d. Mixed flow</td><td></td></tr>
<tr><td>Q 4</td><td>Write five points about the potential of SHP in India</td><td>CO 4</td></tr>
<tr><td>Q 5</td><td>List various financial indicators of SHP considered by the investors.</td><td>CO 4</td></tr>
<tr><td>Q 6</td><td>List five environmental impacts of small hydro power plant.</td><td>CO 6</td></tr>
<tr><td colspan="3">SECTION B
1. Each question will carry 10 marks
2. Instruction: Write short / brief notes</td></tr>
<tr><td>Q 7</td><td>a. The rainfall data for a catchment is given below:

<table>
<tr><td>Time period in hours</td><td>0-2</td><td>2-4</td><td>4-6</td><td>6-8</td><td>8-10</td><td>10-12</td><td>12-14</td><td>14-16</td></tr>
<tr><td>Rainfall in cm</td><td>5.5</td><td>3.5</td><td>10.0</td><td>5.0</td><td>3.0</td><td>0.0</td><td>8.0</td><td>3.5</td></tr>
</table>
Draw the rainfall hyetograph. If the Φ- index is 2.5 cm/h, calculate the runoff. [5M]

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. [5M]</td><td>CO 1</td></tr>
<tr><td>Q 8</td><td>Discuss the essential factors for designing small hydro power plant.</td><td>CO 2</td></tr>
<tr><td>Q 9</td><td>Explain in detail about the speed and voltage regulation applied for SHP plants with the help of a case study.</td><td>CO 3</td></tr>
<tr><td>Q 10</td><td>A 12kW micro hydro project for grain milling is proposed. It has a start up cost of Rs. 2000000. The discount rate is 20%. An energy survey relating to the project established that the grain milling operation will 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?</td><td>CO 4</td></tr>
<tr><td>Q 11</td><td>A closed cycle plant in Austria, with a gross head of 300m, has a headrace tunnel 4m dia and 700m long. The powerhouse discharges directly in the lower reservoir. The flow velocity is 6.5 m/s and the friction factor f = 0.018. If the overall efficiencies of pumping and generation are 88% and 90% respectively, estimate the plant efficiency.</td><td>CO 5</td></tr>
<tr><td colspan="3">Section C
1. Each Question carries 20 Marks.
2. Instruction: Write long answer.</td></tr>
<tr><td>Q 12</td><td>The average direct runoff calculated from hydrological studies is 930 m3/s. From this 800 m3/s is allowed to satisfy the agricultural need and the remaining is allowed into the hydropower channel. Calculate head loss due to friction and the desired effective thickness for the penstock of 6m diameter.

Given:

Gross head = 32.5m.
Lhorizontal = 44.37 m.
Roughness k = 0.18 mm.</td><td>CO 1</td></tr>
</table>

The turbulent losses Kentrance = 1, Kbend1 = 0.38, Kbend2 = 0.38, Kvalve = 0.1
E = 100 x 109 N/m2
S = 140 x 106 N/m2
Pressure wave velocity = 1320 m/s.

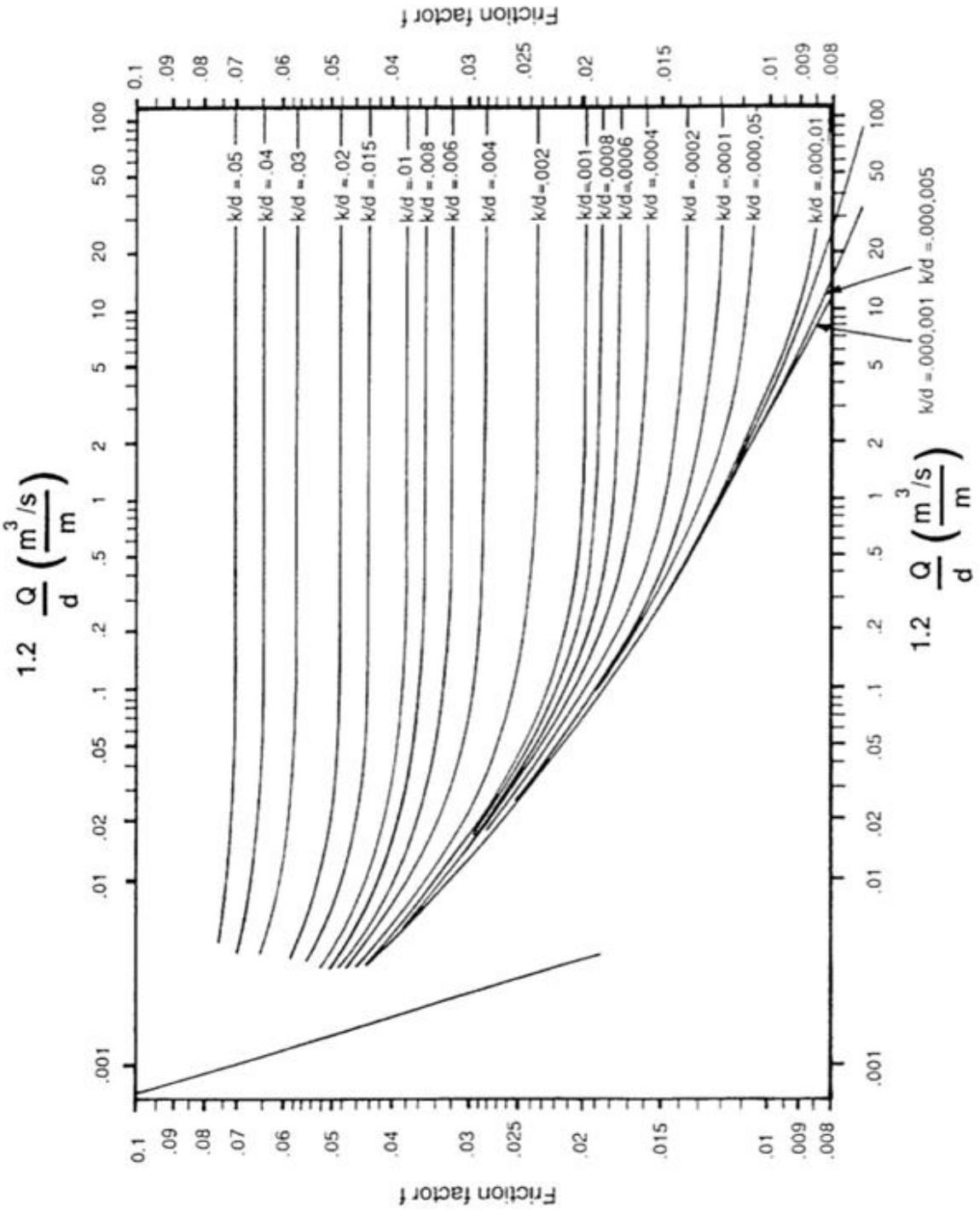

Figure 1 Moody Chart