

B. Power Engineering Examination, 2018

3rd Year 2nd Semester.

Subject: Hydro Power Generation

Time: Three hours

Full marks: 100

Answer any Five Questions

No. of questions		Marks																										
1	<p>What do you mean by co-efficient of variation of annual rainfall? The monthly flows of a stream over the period of the driest year on record are as shown below:</p> <table><tr><th>Month</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th></tr><tr><td>Flow (x10⁶ m³)</td><td>4</td><td>2.25</td><td>5</td><td>1.25</td><td>0.5</td><td>0.75</td><td>0.5</td><td>0.75</td><td>1.25</td><td>1.25</td><td>5</td><td>6.25</td></tr></table> <p>Estimate the maximum possible uniform draw-off from the stream and determine the reservoir capacity to achieve the uniform draw-off and the minimum initial storage to maintain the demand. If the reservoir has only a total capacity of 8 x 10⁶ m³ with an initial storage of 4 x 10⁶ m³, determine the maximum possible uniform draw-off.</p>	Month	1	2	3	4	5	6	7	8	9	10	11	12	Flow (x10 ⁶ m ³)	4	2.25	5	1.25	0.5	0.75	0.5	0.75	1.25	1.25	5	6.25	2+18
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Flow (x10 ⁶ m ³)	4	2.25	5	1.25	0.5	0.75	0.5	0.75	1.25	1.25	5	6.25																
2.	<p>The data collected during performance testing of a hydraulic turbine based SHP at 80% load are tabulated below</p> <table><tr><td>Item/Load</td><td>80%</td></tr><tr><td>Discharge (cumec)</td><td>1.902</td></tr><tr><td>Pressure at inlet (kg/cm²)</td><td>7.34</td></tr><tr><td>Duration of test (minute)</td><td>15</td></tr><tr><td>Energy reading (Wh)</td><td>114.44</td></tr><tr><td>CTR</td><td>400A/5A</td></tr><tr><td>VTR</td><td>3.3kV/100V</td></tr><tr><td>TWL (right bank), m</td><td>5.559</td></tr><tr><td>TWL (left bank), m</td><td>5.401</td></tr></table> <table><tr><td>Center line of Penstock (Bench mark): 853.5m above MSL</td></tr><tr><td>Level of pressure transmitter diaphragm: 853.84m above MSL</td></tr><tr><td>Elevation of ULS (left bank): 858.097m above MSL</td></tr><tr><td>Elevation of ULS (Right bank): 858.022m above MSL</td></tr><tr><td>Density of water: 998.5kg/m³</td></tr><tr><td>Accleration due to gravity: 9.78m/s²</td></tr><tr><td>Diamter of penstock where pressure transmitter is fitted: 855mm</td></tr></table> <p>Find the efficiency of the plant.</p>	Item/Load	80%	Discharge (cumec)	1.902	Pressure at inlet (kg/cm ²)	7.34	Duration of test (minute)	15	Energy reading (Wh)	114.44	CTR	400A/5A	VTR	3.3kV/100V	TWL (right bank), m	5.559	TWL (left bank), m	5.401	Center line of Penstock (Bench mark): 853.5m above MSL	Level of pressure transmitter diaphragm: 853.84m above MSL	Elevation of ULS (left bank): 858.097m above MSL	Elevation of ULS (Right bank): 858.022m above MSL	Density of water: 998.5kg/m ³	Accleration due to gravity: 9.78m/s ²	Diamter of penstock where pressure transmitter is fitted: 855mm	20	
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3.	<p>What is hydrograph? Discuss its different limbs with a neat sketch. What are different methods for direct and indirect measurement of run-off? The crest level for a dam spillway is kept at 723.70m while the maximum water level in the reservoir is at 734.50m. Calculate the maximum discharge through the overflow spillway of 61m width. Assume the value of coefficient of discharge as 2.3.</p>	2+2+4+12																										

4.

What do you mean by hydrological cycle?
 What do you mean by a mass curve of runoff?
 How can you determine the storage capacity of a reservoir with the help of a constant or variable demand?
 What do you mean by cavitation?
 Discuss the different types of embankment dams.

2+2+3+3+10

5.

What do you understand by run-of-river plants? Using neat sketch show various components and arrangements of such plants?
 For a run-of-river plant the DPR shows the following values of available head and discharge at different time:

H(m)	13	11.25	11.5	12	11.75	9.75	11	9.5	10
Q(cumec)	100	325	260	180	215	700	370	600	460

Plot power duration curve.

3+3+14

16+4

6.

For a run-of-river plant the discharge data available throughout the year related to the release from all outlets of a dam is given below. The performance testing of the SHP getting water from the dam at 100%, 80% and 60% of rated load gives efficiency of 79.3%, 76.6% and 71.7%. The SHP has two Francis Type machines each consumes 8.5 cumec water 100% load. Calculate the weighted efficiency of the plant.

Month	Discharge (cumec)
January	6.22
February	30.866
March	31.004
April	37.776
May	10.995
June	5.594
July	51.796
August	68.679
September	162.766
October	74.044
November	6.906
December	0

What is meant by economical diameter of a penstock?

7.

Why anchor blocks are used for long penstocks?
 Based on what criteria penstocks are selected?

A Kaplan turbine produces 50,000 bhp under a head of 20m with an overall efficiency of 90%. The ratio of hub to tip-to-tip is 1:3, flow ratio is 0.5 and speed ratio as 2.0. Estimate diameter of boss and turbine speed.

4+4+12