Code No: RR420102 **Set No. 1**

IV B.Tech II Semester Regular Examinations, Apr/May 2006
HYDROPOWER ENGINEERING
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Give a detail history of hydroelectric power development in India. [16]

2. Make a neat sketch of a hydropower plant and show clearly the various elements. Also explain the purpose for which they are provided. [16]

3. It is contemplated to develop a run-off-river plant on a river. The variation of discharge with head was recorded as follows. Plot the power duration curve.

Discharge (cumec)	100	180	215	260	325	370	460	600	700
Head (m)	13.0	12.0	11.75	11.5	11.25	11.0	10.0	9.5	9.25

[16]

4. (a) Explain with sketches, spherical valves and butterfly valves used in the hydro electric installation.

   (b) A penstock, with an internal diameter of 1.3 m, supplies water at a head equivalent to 17.6 kg/cm^2. There is a possibility of 22 per cent increase in the pressure due to transient conditions. The design stress and the efficiency of the joint may be assumed to be 1020 kg/cm^2 and 85 per cent respectively. Calculate the approximate wall thickness of the penstock required. [8+8]

5. A rectangular channel has sides 2.50 m high and conveys water at a depth of 1.6 m at a velocity of 1.9 m/s. The channel is 1200 m long. If the flow is suddenly stopped by closing a gate at the downstream end of the channel, determine whether the water will spill over the side as a consequence of surge produced. Find also the interval of time required for the surge to reach the upstream end of the channel. [16]

6. The following results were obtained in a test on a Pelton wheel turbine:
   Head at the base of the nozzle = 34.5 meters
   Discharge of the nozzle = 0.2 m^3/sec
   Area of the jet = 80 cm^2
   Shaft power developed =55.20 kW
   Power absorbed in mechanical resistance and windage=3.30 kW
   Find

   (a) Power lost in the nozzle and

   (b) Power lost in the runner. [16]

7. (a) Describe model testing of turbines and its purpose.

(b) A model of francis turbine, one fifth of full size, develops 3KW at 306rpm under a head of 1.77m. Find the speed and power of full size turbine operating under a head of 5.7m if the efficiency of the model and the full size turbine are same [8+8]

8. (a) What are the various ways of locating of underground power stations?

(b) What are the limitations of underground power house. [8+8]

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1. (a) Explain the term load factor, plant factor and utilization factor.
   (b) Differentiate between firm power and secondary power. [9+7]

2. Define valley dam plants and trans-basin diversion power plants. Give examples of both the types with brief description and neat sketches. [16]

3. (a) Describe the basic features of the pumped storage power plant.
   (b) A closed cycle pumped storage power plant with a gross head of 350 m, has a head race tunnel 4 m dia and 700 m 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 85 % and 88 % respectively, estimate the plant efficiency. [8+8]

4. What is meant by 'economical diameter of a penstock'? How can it be found out? [16]

5. A rectangular channel has sides 2.50 m high and conveys water at a depth of 1.6 m at a velocity of 1.9 m/s. The channel is 1200 m long. If the flow is suddenly stopped by closing a gate at the downstream end of the channel, determine whether the water will spill over the side as a consequence of surge produced. Find also the interval of time required for the surge to reach the upstream end of the channel. [16]

6. The following results were obtained in a test on a Pelton wheel turbine:
   Head at the base of the nozzle = 34.5 meters
   Discharge of the nozzle = 0.2 m^3/sec
   Area of the jet = 80 cm^2
   Shaft power developed =55.20 kW
   Power absorbed in mechanical resistance and windage=3.30 kW
   Find
   (a) Power lost in the nozzle and
   (b) Power lost in the runner. [16]

7. (a) Explain unit speed, unit quantity and unit power of turbine.
   (b) What do you mean by the specific speed of a turbine. What is the significance fo it. [8+8]

8. Explain in detail about the unit bay, loading bay and control bay of the super structure. [16]

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Code No: RR420102 **Set No. 3**

IV B.Tech II Semester Regular Examinations, Apr/May 2006
HYDROPOWER ENGINEERING
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A run-of-stream station with an installed capacity of 15,000 kW operates at 15 % load factor when it serves as a peak load station. What should be the lowest discharge in the stream so that the station may serve as the base load station? It is given that the plant efficiency is 75 % when working under a head of 20 m. Also calculate the maximum load factor of the plant when the discharge in the stream rises to 20 cumec. [16]

2. What are the different methods of classifying the hydro-electric power plants? Explain them in detail. [16]

3. Following is the record of average yearly flow in a river for 15 years. If the available head is 15 m, construct the flow-duration curve and power-duration curve for the river.

S.No.	1	2	3	4	5	6	7
Year	1956	1957	1958	1959	1960	1961	1962
Flow (cumecs)	905	865	1050	1105	675	715	850

8	9	10	11	12	13	14	15
1963	1964	1965	1966	1967	1968	1969	1970
775	590	625	810	885	1025	1150	925

[16]

4. (a) Explain with sketches, spherical valves and butterfly valves used in the hydro electric installation.

   (b) A penstock, with an internal diameter of 1.3 m, supplies water at a head equivalent to 17.6 kg/cm^2. There is a possibility of 22 per cent increase in the pressure due to transient conditions. The design stress and the efficiency of the joint may be assumed to be 1020 kg/cm^2 and 85 per cent respectively. Calculate the approximate wall thickness of the penstock required. [8+8]

5. (a) Derive the expression for the water hammere pressure in case of rigid pipe.

   (b) A power canal, bed width 15 m, may be assumed to be rectangular in shape with a steady state depth of flow of 3 m. The canal supplies water to a power house with three turbines, each turbine rated at a discharge of 30 m^3/s. If the load in the power house is suddenly thrown off so that two of the turbines have to be shut down, what would be the height of the surge in the canal? [8+8]

6. (a) What is a turbine and what are the various types of turbine? Discuss.
   (b) What do you mean by inward and outward flow turbine. Give few examples for each case. [8+8]

7. (a) Explain unit speed, unit quantity and unit power of turbine.
   (b) What do you mean by the specific speed of a turbine. What is the significance fo it. [8+8]

8. Explain in detail about the unit bay, loading bay and control bay of the super structure. [16]

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Code No: RR420102 **Set No. 4**

IV B.Tech II Semester Regular Examinations, Apr/May 2006
HYDROPOWER ENGINEERING
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. The 95 per cent dependable discharge of a river is 30 m^3/s. If the utilizable head is 30 m, calculate
   (a) The theoretical HP and kW of power from the flow for 95 per cent of time.
   (b) The approximate actual amount of power output.
   (c) Total yearly developable energy.
   (d) The actual capacity that may be installed to utilize all the average flow and the corresponding energy. [16]

2. Why hour-to-hour or day-to-day fluctuations occur in supply or demand to the turbine? How do you cater for the same? [16]

3. It is contemplated to develop a run-off-river plant on a river. The variation of discharge with head was recorded as follows. Plot the power duration curve.

Discharge (cumec)	100	180	215	260	325	370	460	600	700
Head (m)	13.0	12.0	11.75	11.5	11.25	11.0	10.0	9.5	9.25

[16]

4. What are penstocks and of which material can they be manufactured? Under what circumstances each material can be used? [16]

5. (a) Describe with neat sketch about simple cylindrical surge tank.
   (b) A rectangular channel 3 m wide conveys water at a velocity of 2.5 m/s, the depth of flow being 1.25 m. The rate of flow at the upstream end is suddenly increased so as to increase the depth of flow to 2.5 m. Find the absolute velocity of the surge produced and the new discharge. [8+8]

6. (a) What are the various ways of classifying turbines? Explain.
   (b) Define hydraulic efficiency, mechanical efficiency, volumetric efficiency and overall efficiency. [8+8]

7. (a) What do you mean by characteristic curves of turbines. How they are useful. Describe constant head characterestic curves with the help of a neat sketch.
   (b) A model of a turbine 0.3m diameter when running at 900 rpm under a head of 12m gane the following results.

Percentage gate opening	40	60	80	100
Output power kW	8.38	13.24	17.5	19.71

The actual turbine is required to develop 7360 kW at 85% gate opening under a head of 35m. Assuming same efficiency at corresponding gate opening for the model and actual tuebines find:

i. diameter and speed of actual turbine and

ii. output of actual turbine at 50% gate is opening. [8+8]

8. (a) Give in detail various advantages of underground power house.

(b) Compare and contrast surface power station and underground power stations. [8+8]

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