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

IV B.Tech II Semester Supplementary Examinations, June 2007
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) What are the various sources of energy for generation of power?
   (b) How would you estimate waterpower potential? [8+8]

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. Following is the record of average yearly flow in a river for 15 years. If the available head is 16 m, construct the flow-duration curve and power-duration curve for the river.

S.No	1	2	3	4	5	6	7
Year	1962	1963	1964	1965	1966	1967	1968
Flow (cumecs)	925	890	1070	1125	700	735	870

8	9	10	11	12	13	14	15
1969	1970	1971	1972	1973	1974	1975	1976
790	610	640	835	905	1040	1170	940

[16]

4. (a) Explain in detail the various problems caused due to ill-designed gates and valves used in a penstock.
   (b) Explain with sketches, needle valves and Howell-Bunger valves. [8+8]

5. What is meant by the celerity of wave in power canals? Derieve an expression for the same. [16]

6. The three-jet Pelton turbine is required to generate 10,000 kW under a net head of 400 m. The blade angle at outlet is 15^0 and the reduction in the relative velocity while passing over the blade is 5 %. If the overall efficiency of the wheel is 80%, C_v=0.98 and speed ratio = 0.46, then find:
   (a) the diameter of the jet,
   (b) total flow in m^3/s and
   (c) the force exerted by a jet on the buckets.

   If the jet ratio is not to be less than 10, find the speed of the wheel for a frequency of 50 hertz/sec and the corresponding wheel diameter. [16]

7. (a) Enumerate the different types of draft tubes and draw them neatly

(b) What is canitation. What is Thomas canitation factor and what is its significance for water turbines. [8+8]

8. (a) Briefly explain, how the structure of a power house is to be designed.

(b) Describe with neat sketch different types of underground power stations. [8+8]

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Code No: RR420102 **Set No. 2**

IV B.Tech II Semester Supplementary Examinations, June 2007
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) What are the various sources of energy for generation of power?
   (b) How would you estimate waterpower potential? [8+8]

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

3. (a) Give a brief historical development of a pumped storage power plant?
   (b) A 100 MW reversible pump-turbine has to work under a head of 400 m. Choose a suitable specific speed and running speed for the machine. [8+8]

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) Describe with neat sketch about differential surge tanks.
   (b) A rectangular channel 2 m wide has a flow with a velocity of 2 m/s and a depth of flow of 1.25 m. The rate of flow at the downstream end is suddenly decreased such that the depth of flow is increased to 2 m. Find the absolute velocity of the resulting surge and the corresponding 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) Enumerate the different types of draft tubes and draw them neatly
   (b) What is canitation. What is Thomas canitation factor and what is its significance for water turbines. [8+8]

8. (a) Briefly explain, how the structure of a power house is to be designed.
   (b) Describe with neat sketch different types of underground power stations. [8+8]

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

IV B.Tech II Semester Supplementary Examinations, June 2007
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. (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 are the various ways of classifying penstocks? Describe each of them with neat sketches. [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 why the draft tube is to be provided in reaction turbines. Also describe the draft tube theory.
   (b) Calculate the value of Thomas cavitation parameter for a kaplan turbine having non-dimensional specific speed of 19.36 and suction specific speed of 17.6. [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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Code No: RR420102 **Set No. 4**

IV B.Tech II Semester Supplementary Examinations, June 2007
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. A run-off-river hydroelectric power station is proposed across a river at a site where a net head of 25 m is available on the turbine. The river carries a sustained minimum flow of 30 m^3/sec in dry weather and behind the power station sufficient pondage is provided to supply daily peak load of demand with a load factor of 71 %. Assuming the plant efficiency of 56.4%, determine the maximum generating capacity of the generator to be installed at the powerhouse. If the daily load pattern indicates 21.5 hours average load and 2.5 hours of peak load, determine the volume of pondage to be provided to supply the daily demand. [16]

3. (a) Give a brief historical development of a pumped storage power plant?
   (b) A 100 MW reversible pump-turbine has to work under a head of 400 m. Choose a suitable specific speed and running speed for the machine. [8+8]

4. A hydro-electric station is to be supplied with 10 m^3/sec of water through a penstock which has a friction factor of 0.016. The maximum normal head on the penstock is 50 kg / cm^2 and a water hammer overpressure of 20 % over the normal pressure is anticipated. The safe stress in the steel used is presumed to be 3000 kg/cm^2. The ready penstocks at site are likely to cost Rs 15000 per tonne including erection charges. The life of the project is 50 years and the rate of interest is 7 per cent. It is proposed to sell the energy at the rate of Rs. 0.03/kWh. What should be the optimum diameter of the penstock, given that the OMR cost are 5 per cent. Assume the turbine efficiency to be 90 per cent and the annual load factor as 0.4. [16]

5. What is meant by the celerity of wave in power canals? Derieve an expression for the same. [16]

6. A pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The Pelton wheel develops 95.6475 kW shaft power. The velocity of the buckets = 0.45 times the velocity of the jet, overall efficiency = 0.85 and co-efficient of velocity is equal to 0.98. [16]

7. (a) What do you mean by cavitation and what are the effects of cavitation?
   (b) What is a draft tube? What are the functions of draft tube? [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]

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

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