

15255

**B. Tech 7th Semester Examination**

**Hydro Power Station Design (OS)**

**EE-7005A**

**Time : 3 Hours**

**Max. Marks : 100**

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting one question from each of the section A, B, C, and D and all the subparts of the question in Section E. Marks for each question are given in bracket and assume missing data if any suitably.

**SECTION - A**

1. (a) Explain the application of hydrology in the design of hydro power plant. (6)
- (b) A hydro power plant operates under an effective head of 200 m and a discharge of 125 cumecs. Assuming the overall efficiency of the plant to be 85%, find the power developed and energy generated annually. (8)
- (c) State the criteria for the selection of site for a hydro power plant. (6)
2. (a) Explain the concept of base load and peak load power plants with the help of a load curve. State the suitability of hydro power plant for any one of the above load management techniques giving reasons for your choice. (10)
- (b) Draw the layout plan for a hydro power plant and explain the function of each component. (10)

**[P.T.O.]**

**SECTION - B**

3. (a) Explain the concrete gravity dam construction for a hydro power plant and state its advantages and disadvantages over earthen dam. (10)
- (b) A common load is shared by two hydro power plants; one being a base load power plant with 25 mW installed capacity and other being a standby station with 30mW capacity. The yearly output of standby station is  $10.5 \times 10^6$  kWh and that of the base load plant is  $125 \times 10^6$  kWh. The peak load taken by the standby station is 15 mW and this station works for 2500 hours during a year. The base load station takes a peak load of 22.5 mW. Determine: (i) Annual load factor for both stations (ii) plant use factor for both stations and (iii) capacity factor for both stations. (10)
4. (a) Explain the reaction turbines and their suitability for a particular type of hydro power plants. Give examples of such turbines, (10)
- (b) What is a draft tube? State its various types and function in a hydro power plant. (10)

**SECTION - C**

5. (a) Explain the construction and working of Kaplan turbine and state its suitability. (10)
- (b) Explain runaway speed of a turbine. Explain the turbine governing mechanism in a Pelton Wheel turbine. (10)
6. (a) Derive the expression for the specific speed of a hydro turbine in terms of power developed, the speed and the head available. (10)
- (b) A turbine develops 10,000 kW under a head of 25 meters at 135 rpm. What is its specific speed? What would be its normal speed and output under a head of 20 meters? (10)

**SECTION - D**

7. (a) Explain the different types of penstocks used in hydro power plants. (10)
- (b) Derive an expression for the most economic diameter of a penstock used in a hydro power plant. (10)
8. (a) Explain the design features of a hydro generator. How it differs from thermal power plant generators? (10)
- (b) Explain the load circuit characteristics of an alternator. How reactive power control is achieved? (10)

**SECTION - E**

9. (a) Define hydrograph and its function.
- (b) State the function of floating boom.
- (c) State the functions of exciter.
- (d) Function of deflector in turbine.
- (e) State the various head losses.
- (f) Define unit head and its importance.
- (g) State the function of by-pass valve.
- (h) What is a forebay and its function?
- (i) State the function of spillway.
- (j) Define cavitation and its impact on turbines. (10x2=20)