

B.E. (Civil Engineering) Eighth Semester (C.B.S.)
Elective-II : Water Power Engineering

P. Pages : 2

Time : Three Hours



NRT/KS/19/3621

Max. Marks : 80

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- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.
 11. Use of non programmable calculator is permitted.

1. a) What are the components of a water power project? Explain in brief. **6**
b) What are the various types of hydro power schemes, draw a general layout of one of them. **7**

OR

2. a) Explain salient features of an underground power station. What are its necessity? **6**
b) How the layout of under ground power station is decided? What are the types of underground power station? Also states its limitations. **7**
3. Explain the following- **13**
 - i) Application of unit hydrograph.
 - ii) Mass curve technique.
 - iii) Flow duration curves.

OR

4. a) Differentiate **6**
 - i) Gross head and net head.
 - ii) Storage and pondage.
b) Explain the terms - load factor, plant use factor, firm power and secondary power. **7**
5. What do you mean by a penstock and how is it classified? **13**
Derive an expression for economical diameter of penstock.

OR

6. Write short notes on **13**
 - i) Classification of tunnel
 - ii) Tunnel lining
 - iii) Intake structures
 - iv) Trash rack

7. a) What are various types of surge tanks? 7
 b) A power canal of bed width 15 m and has a rectangular section with depth of flow of 3.0 m. The discharge is 90 m³/sec. The canal supplies water to power house with three turbines at a rate of 30 m³/sec. 7

If the load in the power house is suddenly thrown off so that two of the turbine have to be shut down. What would be the height of surge created in the canal?

OR

8. a) What are the hydraulic design criteria of a simple surge tank? 9
 b) Explain a forebay with its functions. 5
 9. a) Differentiate impulse and reaction turbines. 4
 b) What are various types of turbines? Explain criterion wise classification. 5
 c) Draw velocity triangle for a modern Francis turbine. 5

OR

10. a) Define specific speed of a turbine and give its significance. Derive the expression for it in the following form. 9

$$N_S = \frac{N\sqrt{P}}{H^{5/4}}$$

Where N_S = Specific speed in rpm
 N = Speed in rpm
 P = Power developed in KW
 H = Head in 'm'

- b) What is a draft tube? what are its necessity? 5
 11. a) What are the basic features of a pump storage plant? Enumerate advantage of it. 7
 b) At a pump storage project two reversible pump turbine have been installed. It has the following rating curve during the pumping operation. 6

Speed = 225 rpm
 Head = 230 m
 Discharge = 86 m³/sec

Determine the specific speed of the pump unit and suggest the approximate submergence necessary from following rating.

Head (m)	200	225	250	275	300
Submergence (m)	36.0	32.0	28.0	28	25

OR

12. a) Explain the economics of a pump storage plant. 7
 b) A closed cycle pump storage plant with a gross head of 350 m has a head race tunnel 4.0 m dia. and 700 m long. The power house discharges directly to the lower reservoir. The flow velocity is 6.5 m/sec and friction factor for the tunnel is 0.02. If overall efficiency for pumping and generation are 80% and 75% respectively. Estimate the plant efficiency. 6
