ELECTIVE - II
Water Power Engineering
(New) (1311)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **two** questions from each unit.
5. Assume suitable data wherever necessary and mention it clearly.
6. Neat sketch / diagram should be drawn wherever necessary.
7. Black figure to the right indicates full marks.
8. Use of non-programmable pocket electronic calculator is allowed.

UNIT - I

1. a) Discuss the present status of hydroelectric power generation in India. **5**

   b) Describe in brief the base load and peak load power plant. **5**

2. The run off data of a river at particular site is tabulated below: **10**

Month	Mean Discharge in millions of cum per month	Month	Mean Discharge in millions of cum per month
Jan.	80	July	150
Feb.	50	Aug.	200
Mar.	40	Sept.	250
April	20	Oct.	120
May	0	Nov.	100
June	100	Dec.	80

   a) Draw the hydrograph and find the mean flow

   b) Also draw the flow duration curve.

   c) Find the power in MW available of mean flow, if the head available is 110m and overall efficiency of generation is 82.5%

3. a) A hydroelectric power plant has to operate with a mean head of 30 m and supplied from a whose catchment area is 250 sq. km and average rainfall is 125 cm per year. If the 70% of the rainfall can be used at a expected load factor of 50%. Calculate the power in kw for which the station can be designed. Assume head loss in the system, mechanical efficiency of turbine is 90% and generator efficiency is 95%. **6**

    b) Describe the following in brief: **4**

    i) Annual load factor.

    ii) Capacity factor.

UNIT - II

4. a) How the hydroelectric power plants are classified. **5**

    b) Differentiate between the storage and pondage. **5**

5. A load required by the consumers from the power plant for 24 hours is tabulated as given below. **10**

Time Period	6.00 to 10.00 Hrs	10.00 to 18.00 Hrs	18.00 to 24.00 Hrs	0.00 to 6.00 Hrs
Load in mw	60	120	40	10

   a) Find the net revenue earned if the load is taken by single thermal power plant. The energy rate is Rs.1.50 per kw hour and cost of input is Rs.2.2 per 20,000 kJ. The thermal efficiency of the plant may be taken as 40% at 120 mw, 35% at 60 mw, 30% at 40 mw and 20% at 10 mw load.

   b) If is proposed to take the above load by a combined thermal and pumped storage plant. If the thermal plant always runs at constant load with 40% thermal efficiency and overall efficiency of pump storage plant is 80%, find the capacity of the thermal plant required and percentage increase in the revenue earned. The cost of power sell and cost of energy input is same.

6. a) How the energy and power is estimated in case of tidal hydroelectric power plant. **5**

    b) How the pumped storage hydroelectric power plant differs from traditional hydroelectric power plant. Explain the functioning of pumped storage hydroelectric power plant with the help of sketch. **5**

UNIT - III

7.   a)   Describe different types of power houses in use.   **5**

       b)   Describe the different types of facilities which are essential to be provided in a power house.   **5**

8.   Describe the water hammer phenomenon with the help of neat sketch. Derive an expression for water hammer pressure in penstock considering the elasticity of material..   **10**

9.   a)   What are different types of intakes ? Discuss any one of them with neat sketch.   **5**

       b)   Mention the different types of valves which are used in hydroelectric power plant. Also mention their function and location of each.   **5**

UNIT - IV

10.   Explain the functioning of solar water heater with neat sketch.   **10**

11.   a)   How the biomass conversion takes place ?   **5**

       b)   Enumerate the different factors which affect the biodigestion.   **5**

12.   What is meant by energy plantation ? What are its advantages and disadvantages.   **10**

UNIT - V

13.   a)   How the wind energy conversion systems are classified ? Discuss in brief.   **5**

       b)   What are the merits and limitations of wind energy ?   **5**

14.   Write short notes on following.

       a)   Wind energy conversion system - working with the help of neat sketch.   **5**

       b)   Main considerations in selecting site for wind farm.   **5**

15. The diameter of a wind turbine is 120 m and its operating speed is 40 rpm corresponding to maximum efficiency. The wind velocity is 16 m/s at standard atmospheric pressure and temperature considering the mass density of air at

STP equal to $1.226 \, kg / m^3$ and $R = 287 \, J / kg°k$, Calculate

   i)   Total power density and maximum obtainable power density at efficiency = 40%

   ii)   Total power produced in kw.

   iii)   Torque and axial thrust.   **10**

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