

EX/ME/M1/PE/B/T/423G/2022

MECHANICAL ENGG. Final Year 2nd SEMESTER EXAMINATION 2022

Subject : HYDRO WIND & WAVE POWER (Elective)

Time: Four Hours

Full Marks :70

*Answer any **five** questions*

- 1.a) How would you place hydropower in the mix of different powers ?
- b) Explain the terms and the relation among Hydrology, Hydrometeorology and Hydrologic Cycle.
- c) How water power can be estimated ?
- d) What are the disadvantages of Hydrel Power ? 2 + 6 +3 +3
- 2, a) Describe the principle of working for any one infiltrometer.
- b) Discuss Horton's equation for infiltration along with infiltration curve.
- c) Explain the method of ϕ -index.
- d) A 24-hour storm occurred over a catchment of 1.5 sq. km over which 10 cm of rainfall had occurred. As infiltration capacity curve of empirical constant $k = 4.5 \text{ hr}^{-1}$ prepared for the purpose, indicated that the infiltration capacity beginning with a value of 9mm/hr attained a value of 3 mm/hr after 15 hours of rainfall. A standard floating pan installed in the catchment indicated a decrease of 6mm in the water level during 24 hours of its operation. Other losses were found to be insignificant. Determine the runoff for this catchment. 3+ 3 +3 +5
3. a) Explain the phenomenon of water hammer.
- b) Derive an expression for pressure rise due to sudden closure of valve considering the pipe material to be rigid.
- c) Explain the working principle of surge tank.

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d) What are the different types of Surge tanks ? 2 + 6 + 3 + 3

4. a) What are the different materials generally used for making penstock ?

b) Explain banded and multilayer penstocks ?

c) How can you determine the number of Penstocks ?

d) How can you determine economical diameter of penstock graphically ?

2 + 3 + 3 + 6

5. a) Define the followings :

i) load factor, ii) capacity factor, iii) utilization factor, iv) secondary power.

b) A common load is shared by two stations, one being a base load plant with 25 MW installed capacity and other being a standby station with 30 MW capacity. The yearly output of the station is 10.5×10^6 kwh. The peak-load taken by the standby station is 15 MW and this station works for 2500 hours during the year. The base load station takes a peak of 22.5 MW. Find out

i) Annual load factors for both stations. ii) Plant factors for both stations. iii) Capacity factors for both stations. 4 x 1.5 + 8

6. a) What is the basic principle of Tidal Power generation ?

b) What should be the criteria for the location of tidal power plant ?

c) Discuss the difficulties in tidal power generation.

d) Explain double-cycle system of tidal power generation.

e) How can you estimate energy and power developed in a tidal power plant.

3 + 3 + 3 + 5 + 3

7.) Explain a recording type rain gauge with a neat sketch.

b) Calculate the average precipitation by the average method and Thiessen Polygon method from the following data :

Station No.	Precipitation (mm)	Area (sq. km)
1	67	82
2	85	80
3	93	92
4	117	75
5	130	32
6	52	50

c) Explain the method of isohyets for determining the average rainfall of a region.

6 +6 +2

8. a) How can you determine the power in the wind ?

b) Explain the working principle of wind turbine .

c) Show that maximum efficiency or power coefficient for wind power is theoretically is 0.59

2.5 + 2.5 + 9

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