

M.E.MECHANICAL ENGG. 1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER EXAMINATION 2018

Subject : ADVANCED HYDRO POWER ENGINEERING

Time: Three Hours

Full Marks :100

*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, Hydro meterology and Hydrologic Cycle.
- c) How water power can be estimated ?
- d) What are the disadvantages of Hydel Power ? 3 + 9 +4 +4
- 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  $\phi$ -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. 6+ 4 +3 +7
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.

d) Derive the expression of specific speed. 3 + 10 + 3 + 4

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) What is economical diameter of penstock ?

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

3 + 4 + 3 + 3 + 7

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  $10.5 \times 10^6$  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 2 + 12

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.

4 + 5 +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. 8 +8 +4

8. Write short notes on any four of the followings :

a) Pumped storage plant, b) Penstocks, c) Evaporation Pan, d) Thiessen Polygon method of processing precipitation data, e) Rain gauge, f) Unit power and discharge.

4 x 5

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