BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING)
THIRD YEAR SECOND SEMESTER EXAM 2023

HYDRO, WAVE & WIND POWER

Time: Three hours **Marks: 100**

(*Answer any **FIVE** questions*)

Different parts of the same question should be answered together.
All symbols carry their usual meanings unless otherwise mentioned.
Assume any relevant data if necessary.

1. a) What is hydrologic cycle? Briefly explain its different components with a neat sketch. 7

   b) What is runoff? Explain the different factors affecting the runoff. 7

   c) What is water hammer? Explain its causes and effects. 6

2. a) Show the major components of a small hydroelectric power plant with a neat sketch. Discuss briefly their function. 8

   b) A Pelton wheel has to develop 13230 kW under a net head of 800 m while running at a speed of 600 rpm. If the coefficient of Jet Cv = 0.97, speed ratio ϕ = 0.46 and the ratio of the Jet diameter is 1/16 of wheel diameter. Calculate i) Pitch circle diameter ii) the diameter of jet iii) the quantity of water supplied to the wheel and iv) the number of Jets required. Assume overall efficiency as 85%. 12

3. a) What are the advantages and dis-advantages small hydro power plants? 6

   b) What are the site selection criteria of small hydro plant? 5

   c) A Kaplan turbine delivers 10 MW under a head of 25 m. The hub and tip diameters are 1.2 m and 3 m. Hydraulic and overall efficiencies are 90% and 85%. If both velocity triangles are right angled triangles, determine the speed, guide blade outlet angle and blade outlet angle. 9

4. a) Discuss merits and demerits of wind power? 6
   b) Derive the expression for the maximum power developed by a wind turbine. 8
   c) Draw a schematic showing all major components of wind power system. 6

5. a) What is wave power? Explain the advantages and limitations. 8
   b) Describe any three wave energy conversion technologies with neat sketch. 12

6. a) What do you mean by tidal power? Explain how power can be harnessed from tides? 8
   b) Explain the operation of single basin double effect scheme with neat schematic diagram. 6
   c) What are the different turbines used in tidal power plant? 6

7. Write short notes on: (any **FOUR**) 4 X 5 20
   a) Mass curves and flow duration curves
   b) Pumped storage power plant
   c) Site selection criteria of wind farm
   d) Specific speed of water turbine
   e) Power-Velocity characteristics of wind power system
   f) Draft Tube