Centre for Open and Distance Learning
TEZPUR UNIVERSITY
DRE 104: Wind and Hydro Energy
Assignments
Full Marks: 30

(Answer all questions; Start answering each question on a new page)

1. (a) What is the maximum energy available from the wind?
   (b) Write down the different steps to be followed for designing a wind turbine.
   (c) Write down the assumptions used in axial momentum theory and blade element theory.
   (d) What are the various factors considered in designing a hydroelectric power plant?
   (e) Discuss the operation of pumped hydro storage project.

   4×4=16

2. A wind machine with 60 m diameter rotor has cut-in, rated and cut-out wind speed of 4 m/s, 12 m/s and 24 m/s respectively. The rotational speed of the wind turbine is 15 rpm. The mechanical and electrical efficiencies for all the wind speed are 0.95 and 0.96 respectively. The coefficient of performance (C_p) is a function of tip speed ratio (λ) and is given by

$$C_p = 0.189 + 0.0123\lambda^2 - 0.00092\lambda^3$$

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3. The available discharge and head of a proposed hydroelectric power plant are 350 m³/s and 30 m respectively. The turbine efficiency is 87%. The generator is directly coupled to the turbine. The frequency of the generator is 50 Hz and the number of poles is 24. Find the least number of machines if using (a) Francis turbine having a specific speed of 300 and (b) Kaplan turbine having a specific speed of 820.

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