

**BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING) FIFTH
YEAR SECOND SEMESTER EXAMINATION-2019**

INTRODUCTION TO WIND ENGINEERING

Time: 3 hours

Full Marks: 100

Answer any FIVE

1. a) Describe the structure of a Darrieus wind turbine. What are its advantages and disadvantages? 14
b) The Sandia 17-m Darrieus is rated at 60 kW at 15.5 m/s and 52.5 rpm, and at 25 kW at 11 m/s and 42 rpm. The area A is 187 m². Compute the rated overall efficiency at each rating and standard conditions. 6

2. a) Discuss the working principle of a Savonius wind turbine and state its major advantages and disadvantages. 8
b) Show that the theoretically maximum possible efficiency of a wind turbine is about 59.3%. 12

3. a) Compare graphically typical performance characteristics of different wind turbine systems. 8
b) Explain the principle on which a Madaras rotor operates. 7
c) How many gear stages are required in the transmission for the Sandia 17-m Darrieus to drive a 1800 rpm generator for each of the proposed speeds of 42 and 52.5 rpm? Assume the maximum gear ratio for a single stage is 6:1. 5

4. a) Discuss the distribution of wind patterns over the earth's surface. 14
b) If the average wind speed of 20 km/hr yields 150 watts per square meter, then determine the power produced if the wind speed is 50 km/hr. 6

[Turn over

5. Write short notes on the following wind speed measurement instruments 5 x 4
- a. Rotational Anemometer
 - b. Pressure Plate Anemometer
 - c. Hot Wire Anemometer
 - d. Doppler Acoustic Radar
6. a) Discuss the aerodynamics of wind flow over a wind turbine. 8
- b) Define pitch angle and angle of attack. 5
- c) What do you mean by coefficient of performance? Discuss analytically and graphically the power production from practical turbines. 7