

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER-II • EXAMINATION – SUMMER • 2014

Subject Code: 1723901

Date: 16-06-2014

Subject Name: Wind Energy Engineering

Time: 02:30 pm - 05:00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Describe Doubly Fed Induction Generator. **07**
(b) Derive the blade element theory. **07**

- Q.2 (a)** Derive the Betz Limit for wind turbine. **07**
(b) The following data refers to a wind mill. **07**
Annual average wind speed: 20 m/s
Average air density = 1.16 kg/m^3
Total power capacity = 1.2 MW
Induction factor for wind m/c = 0.18
Determine
1. available power capacity in wind
2. power coefficient of wind mill
3. power density available at wind m/c
total wind farm area required no. of wind mills if rotor diameter is 28 m.

OR

- (b)** Design a Savonius rotor for following data **07**
Power = 100 Watt.
Mean wind speed = 20 km/hr
Mean air density = 1.17 kg/m^3
Transmission loss = 8 %
Ratio of height to diameter = 1.35
Wind passage in rotor = open type

- Q.3 (a)** Define wind and discuss it based on their quality. **07**
(b) Design a propeller type windmill based on following data. **07**
Capacity = 50 KW
Average air density = 1.16 kg/m^3
Tip speed Ratio (TSR) = 4.1
Wind speed = 25 km/hr

OR

- Q.3 (a)** Describe PMG Generator. **07**
(b) It is required to design a wind machine for pumping water. Determine basic factor of **07**
wind m/c based on following.
Average speed of wind = 18 km/hr
Mean air density = 1.017 kg/m^3
Water flow rate = 1000 ltrs/hr
Pump head = 28 m
Pump efficiency = 55 %
Transmission losses = 6 %
Power coefficient of machine = 0.324

- Q.4 (a)** Define Switchgear. Explain various component of Switchgear. **07**
(b) Write short note on following: **07**
1. SCADA 2. PLC and its Application.
- OR**
- Q.4 (a)** Draw and explain Grid connection of WTG. **07**
(b) Explain Energy Storage Requirements with Wind Energy System. **07**
- Q.5 (a)** Explain Hybrid Solar ó Wind Energy system. **07**
(b) Explain Differential Protection Relay for Generator. **07**
- OR**
- Q.5 (a)** Explain Various Wind Farm Topologies. **07**
(b) Give comparison between Asynchronous and Synchronous Generator. **07**
