

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<sup>3</sup>

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<sup>3</sup>

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<sup>3</sup>

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<sup>3</sup>

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**

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