

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME- SEMESTER II- EXAMINATION – SUMMER 2015**

**Subject Code: 2723911****Date: 26/05/ 2015****Subject Name: Wind and small hydro energy system****Time: 2:30 PM – 5:00 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) Explain basic principle of wind energy conversion. What are the effects of atmospheric boundary layer and on wind turbine? **07**
- (b) Design HAWT blade without wake rotation, for tip speed ratio=8, lift coefficient  $C_l=1.2$ , angle of attack=12, number of blades=3, total no of blade elements=10. **07**
- Q.2** (a) Define Chord of blade, Lift force and drag force. The Weibull parameter at a wind farm are  $c = 6$  m/s and  $k=2.0$ . Estimate the numbers of hours per year when wind speed is between 5 to 6 m/s. Estimate the numbers of hours per year that wind speed is greater than or equal to 9 m/s. **07**
- (b) Describe effect of terrain and turbulence on wind characteristics. **07**
- OR**
- (b) List wind speed measuring instruments. Explain cup anemometer. **07**
- Q.3** (a) Derive equation for power coefficient for straight blade vertical axis wind turbine for single stream tube analysis. **07**
- (b) Write short note on SODAR and LIDAR. **07**
- OR**
- Q.3** (a) Explain one dimension momentum theory and derive Betz limit. **07**
- (b) Describe theory of ideal horizontal axis wind turbine with wake rotation. **07**
- Q.4** (a) What are the basic components of hydro power plant? Describe their function in brief. **07**
- (b) Describe methods for speed and voltage regulation for small hydro turbine power plant. **07**
- OR**
- Q.4** (a) Explain concept of wind farm and micro-siting. **07**
- (b) What are the economical and electrical aspects of small, mini and micro hydro turbines? **07**
- Q.5** (a) Describe basic design of micro hydro-electric power station. **07**
- (b) Discuss reliability of small, mini and micro hydro turbines. **07**
- OR**
- Q.5** (a) Define small hydro power plant. Discuss site evaluation methodology for small hydro power plant. **07**
- (b) Classify hydro turbine. Write turbine selection criteria for hydro power plant. **07**

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