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**M.E. / M.TECH. DEGREE EXAMINATIONS, MAY 2019**

Third Semester

**PD16013 – WIND ENERGY CONVERSION SYSTEMS***(Power Electronics and Drives)***(Regulation 2018)****Time: Three Hours****Maximum : 100 Marks**Answer **ALL** questions**PART A - (10 X 2 = 20 Marks)**

1. State the importance of power co-efficient.
2. With an illustration describe the various forces acting on an air foil.
3. Define Tip Speed Ratio and blade solidity.
4. Sketch  $C_p$  Vs  $\lambda$  curves for various types of wind turbines.
5. What do you mean by constant speed constant frequency systems?
6. Draw the block diagram of WECS based on self excited induction generator.
7. What is the need for variable speed WECS?
8. Distinguish between variable speed constant frequency systems and variable speed variable frequency systems.
9. What is low voltage ride through?
10. Define the ramp rate limit of wind power output.

**PART B - (5 X16 = 80 Marks)**

11. (a) (i) Explain the different schemes for wind electric generation. **(8)**  
(ii) What is meant by Sabinin's theory? Explain in detail. **(8)**
- (OR)**
- (b) Derive Betz limit for the power co-efficient of wind turbine using simple momentum theory. **(16)**
12. (a) Discuss in detail various considerations in the design procedure of wind turbine rotor. **(16)**

**(OR)**

- (b) (i) Describe the various types of vertical axis wind turbines with suitable illustrations. (8)
- (ii) Explain various schemes of maximum power extraction applied for a WECS. (8)
13. (a) Derive the steady state model of induction generator and describe its steady state performance characteristics. (16)
- (OR)**
- (b) (i) Explain with necessary equations the drive train model. (10)
- (ii) Describe model of wind speed and wind turbine rotor. (6)
14. (a) (i) With neat illustrations, explain the power-wind speed characteristics. (8)
- (ii) Discuss different modes of operation of DFIG with necessary power flow diagrams. (8)
- (OR)**
- (b) (i) List the various advantages of PMSG over DFIG? (4)
- (ii) Derive the simplified model of PMSG in d-q reference frame. (12)
15. (a) (i) Explain the various grid interconnection requirements of WECS. (8)
- (ii) Sketch the low-voltage ride through characteristics of grid connected WECS and discuss it. (8)
- (OR)**
- (b) Discuss briefly the role of WECS used as ancillary services for frequency and voltage control of the grid. (16)