

**Government College of Engineering, Aurangabad**  
(An Autonomous Institute of Government of Maharashtra)

**M. E. (E.P.S./E.M.D.)F.T.& P.T.(Rev.&Old) Examination**  
End Semester Examination

**EE-514 : Renewable Electrical Power Systems (Elective)**

Time: Three Hours

**22 NOV 2016**

Max Marks: 60

*“Verify the course code and check whether you have got the correct question paper”*

N.B:-

1. Attempt **any five** questions
2. Assume suitable data if necessary and state it clearly
3. Use of programmable calculator is not allowed

- Q.1 a) Draw a neat sketch of Darrieus rotor & shows how lift and drag forces act on it at different positions. (6)
- b) Draw & explain electrical characteristics of real fuel cell (6)
- Q.2 a) Explain construction & principle of operation of following type of wind turbine i) Limited range variable speed with doubly fed induction generator ii) Wide range variable speed with wound rotor synchronous generator (6)
- b) Draw the equivalent circuit of solar cell & derive an expression for open circuit voltage (6)
- Q.3 a) Calculate size of a PV panel required to provide power for lifting 1000 liters of water per day to an over head tank placed at a height of 10 M. Assume 80% efficiency of motor-pump set & 80% efficiency of PV panel (6)
- b) Explain different losses occurring in solar photovoltaic cells & methods to mitigate them (6)
- Q.4 a) With the aid of neat sketches explain any two concentrated solar power technologies. (6)
- b) How power output & capacity factor is obtained from Actual data, Statistical data & Number of hours for which wind speed is exceeded in wind electric generation (6)
- Q.5 a) Calculate the efficiency & peak power of a Si-solar cell operating at 27<sup>0</sup> C with short circuit current of 2.2 A & operating under standard illumination of 1 Sun. the area of cell is 100 cm<sup>2</sup>. also find its efficiency & peak power at 35<sup>0</sup> C if its fill factor is 75 % (6)
- b) Explain construction & principle of operation of following i) Cup type anemometer ii) pressure tube type anemometer (6)
- Q.6 a) Calculate the diameter of 4 kW wind turbine operating at a wind velocity of 7 m/s. its coefficient of performance is 0.4, the mechanical and electrical efficiencies are 90 % & 95 % respectively (6)
- b) The Sun radiates like a 6000<sup>0</sup>K black body. When the power density of such radiations is one sun, the total photon flux is 4.47 X 10<sup>21</sup> (6)

photons/m<sup>2</sup>/second. Almost half of these photons have energy equal or larger than 1.1 eV. Consider a small silicon photocell with 100 cm<sup>2</sup> area. When 2 Volt of reverse bias is applied, the resulting current is 30 nA. i) Assuming 100% quantum efficiency calculate the short circuit

- Q.7 a) Draw & explain I-V Characteristics of solar cell. How this characteristics changes for series & parallel connection (6)
- b) A 40 Meter, three blade wind turbine produces 600 kW at a wind speed of 14m/s Air density is 1.225kg/m<sup>3</sup> under these conditions calculate (6)
- i) Rotor rpm when it operates with 4TSR
  - ii) The Tip speed of the rotor
  - iii) If the generator needs to run at 1800 rpm, calculate the gear ratio
  - iv) Efficiency of complete wind turbine