Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 71083

M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Elective

Electrical Drives and Embedded Control

PX 5072 – POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

(Common to M.E. Power Electronics and Drives)

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Sketch the velocity profile of wind moving through a horizontal axis propeller-type wind turbine.
2. What is the most attractive feature of hydrogen as an energy carrier ?
3. List any four advantages of DFIG compared to PMSG.
4. Draw the steady state electrical equivalent circuit of SCIG.
5. Why coulomb efficiency is considered in batteries instead of energy efficiency ?
6. Compare standalone PV and grid connected PV systems.
7. What are the types of matrix converter control with respect to a conventional inverter control ?
8. Mention the significance of standalone WECS.
9. What are the needs and drawbacks of hybrid renewable energy systems ?
10. Draw the I-V and P-V characteristics of solar PV cell for various irradiances.

PART – B **(5×13=65 Marks)**

11. a) Explain the fixed dome digestor biogas plant with the help of a neat diagram.

(OR)

b) With the help of a neat sketch, explain the principle of operation of Hydrox fuel cell.

12. a) Compare IG, SCIG, PMSM and DFIG wind energy conversion systems based on their operation and applications used.

(OR)

b) Explain the steady state and transient operation of SCIG with necessary waveforms.

13. a) What are the main grid connection issues with its integration to the solar PV systems ?

(OR)

b) A 100-Ah, 12-V battery with a rest voltage of 12.5 V (at its current SOC) is charged at a C/5 rate, during which time the applied voltage is 13.2 V. Using a simple Thevenin equivalent of battery :

i) Estimate the internal resistance of the battery.

ii) What fraction of the input power is lost in the internal resistance of the battery ?

iii) If the charging is done at a C/20 rate, what fraction of the input power would be lost due to the internal resistance ?

14. a) Explain briefly about SVPWM technique used for three-phase two level inverter.

(OR)

b) Explain grid integrated PMSG and SCIG based WECS with the help of neat diagrams.

15. a) Explain the different models of hybrid wind – PV topologies. State the essential requirements of hybrid systems.

(OR)

b) How maximum power point tracking can be done in wind energy conversion systems ? Elaborate any specific MPPT algorithm.

PART – C **(1×15=15 Marks)**

16. a) Analyze the impact of WECS in India with case study and detailed explanation with respect to economic impacts and GHG emissions.

(OR)

b) The Kyocera KC 120 is a 120-W solar PV module with its maximum power point at a current of 7.1 A and a voltage of 16.9 V. The worst solar month is December, with 3.1 peak hours of sunlight at a tilt of L + 15. The off-grid cabin needs 3000 Wh/day of ac delivered from an 85% efficient inverter. For a 24-V system voltage, a 90% Coulomb efficiency and 10% de-rating (de-rating factor = 0.90), size a PV array using Kyocera KC 120 modules for the off-grid cabin.