

B.E Degree Examination, December 2020

Seventh Semester

EE16009 - Power Electronics for Renewable Energy System

(Regulation 2016)

Time: Three hours

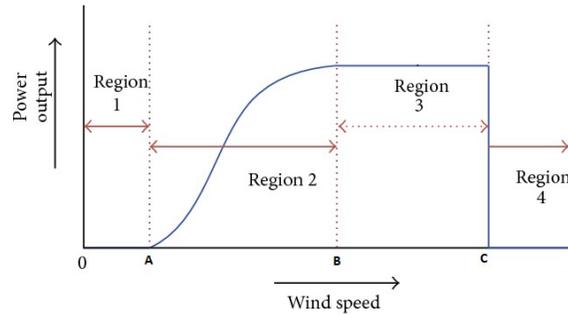
Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. Current produced in a photovoltaic cell depends on
 - a) Intensity of insolation
 - b) Size of cell
 - c) Both (a) and (b)
 - d) None of the above
2. The function of the Gas Diffusion Layer in a PEM Fuel Cell is _____
(can select multiple options also)
 - a) Prevent heat loss during storage
 - b) Distribute reactants uniformly
 - c) Connect the catalyst layer to the bipolar plate electrically
 - d) Provide structural strength
3. In wind power system using asynchronous AC generator with injected EMF, which option is correct: [N_r : rotor speed and N_s : stator speed]
 - a) $N_r < N_s$: power flow from grid side converter to machine side converter
 - b) $N_r > N_s$: power flow from grid side converter to machine side converter
 - c) Power flow does not depend upon N_r and N_s
 - d) None of the above
4. A boost converter is connected as an interface between PV panels and a DC bus for MPPT and the operating point is at peak power point. If the insolation reduces, then
 - a) Duty ratio of converter is to be decreased
 - b) Duty ratio of converter is to be increased
 - c) Load on the converter is to be decreased
 - d) Load on the converter is to be increased
5. Identify the location of pitch bearing in wind mill and why is it placed so?
6. Illustrate the power circuit of grid tied inverter.
7. List out any two grid connection issues and its solution.

8.



Examine the given wind turbine power curve to determine the suitable region for variable speed WECS and justify.

PART B - (4 X16 = 64 marks)

09. (a) Explain the influence of various renewable energy sources with special reference to the global warming context. Also, discuss some solutions to minimize the impact. **(16)**

(OR)

- (b) (i) Explain the working principle of alkaline type fuel cell. **(8)**
(ii) Describe the concept of power generation from Ocean Energy. **(8)**
10. (a) (i) Enumerate the merits and demerits of mains excited and capacitor excited induction generator. **(6)**
(ii) Derive the equivalent circuit and explain the characteristics of induction generator with rotor injected emf and its various operating modes. **(10)**

(OR)

- (b) Discuss the need for grid integration of wind energy system? With power electronic interface circuit, explain how grid integration is done for Permanent Magnet Synchronous Generator (PMSG) based wind energy conversion system. **(16)**
11. (a) Design and estimate the cost of a standalone PV system for a factory floor that uses 25 CFL lights of 20W each. These lights are to be run for 12 hours every day and in the 12 hours of night 10 of these lights will remain ON. What happens if all these lights are replaced with 12W LED light? Assume suitable and necessary values. **(16)**

(OR)

- (b) (i) Design the filter components for a buck converter which has an input voltage of 12V and output voltage of 5V. The peak to peak output ripple voltage is 20mV and peak to peak ripple current of inductor is limited to 0.9A. The switching frequency is 50KHz. **(8)**
- (ii) Explain briefly the working of AC - AC converter that utilizes nine bidirectional controlled switches. **(8)**
12. (a) With neat schematic diagram, design a grid connected hybrid renewable system with battery energy storage and back up diesel generator to meet the load demand of 100 houses in a community. The load comprises of both DC and AC appliances. The power is extracted from solar, wind and biomass power plant. List out the system merits and limitations. **(16)**

(OR)

- (b) State the importance of Maximum Power Point Tracking (MPPT) in the operation of photovoltaic system. Explain in detail any one MPPT technique that uses hill climb search algorithm and compare its features with indirect method. **(16)**