VALLIAMMAI ENGINEERING COLLEGE

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Department of Electrical and Electronics Engineering

Question Bank

PX7301 Power Electronics for Renewable Energy Systems

PART - A

UNIT – I

1. List various renewable energy resources.
2. State the significance of renewable energy.
3. What is GHG emission?
4. List three major factors influencing the amount of GHG emissions.
5. How is a fuel cell characterized?
6. What are the types of fuel cell?
7. How biomass conversion takes place?
8. What is meant by anaerobic digestion?
9. List the advantages of anaerobic digestion.
10. List various types of bio gas plants.
11. List various factors affecting Bio digestion.
12. What is meant by spring and neap tides?
13. What is the principle of power generation using tides?
14. List the limitations of Tidal energy.
15. Mention various ocean tidal energy conversion schemes available.
16. What are the advantages of ocean wave power?
17. List various types of devices available for capturing wave power.
18. What are the problems associated with tapping solar energy?
19. What are the factors influencing solar power extraction?
20. How to use hydrogen energy to generate electric power?

UNIT - II

1. What is the basic principle of wind energy conversion?
2. Why are induction generators preferred over dc generators in WECS?
3. What are the advantages of IG used in WECS?
4. Write the steady state equation of a PMSG.
5. Mention the advantages of PMSG.
6. What is principle of operation of induction generators?
7. State the difference between induction generator and synchronous generator.
8. What are the merits of squirrel cage induction generators for wind energy conversion?

9. What are the characteristics of SCIG?
10. What are the constructional differences between SCIG and DFIG?
11. State the advantages of induction generator based wind energy conversion system.
12. Bring out the merits and demerits of mains excited induction generator.
13. List the merits and demerits of capacitor excited induction generator.
14. Draw slip-torque characteristics of induction generator.
15. State the principle of PMSG.
16. What are the characteristics of DFIG?
17. State the difference between synchronous generator and PMSG.
18. What is the principle of operation of PMSG?
19. What are the merits of PMSG for WECS?
20. Draw the silp-torque characteristics of PMSG.

UNIT - III

1. Draw the block diagram of solar photovoltaic system.
2. What is battery sizing?
3. Define array sizing.
4. Bring out the delicacies involved in sizing the solar arrays.
5. What are the factors to be considered for the selection of inverter and batteries for solar energy conversion?
6. What is line commutated converters?
7. What is inversion mode of operation of line commutated inverter?
8. Draw the schematic diagram of line commutated converter.
9. What is the significance of buck boost converter?
10. Draw the schematic diagram of buck boost converter.
11. List the advantages of buck boost converter.
12. Draw the schematic of boost converter.
13. What is the role of capacitor and the minimum value required for the boost converter?
14. What is three phase AC voltage controller?
15. What are the advantages of uncontrolled rectifier?
16. What are the advantages of dc link inverters?
17. What are matrix converters?
18. What is a grid interactive inverter?
19. List the limitations in the operation of matrix converter.
20. What are the merits of matrix inverters?

UNIT - IV

1. What is meant by fault ride through capability?

2. What is meant by energy payback period?
3. Draw the basic block diagram of WECS.
4. Why pitch angle control is used for WECS?
5. What is stand-alone operation of fixed speed WECS?
6. What are the advantages of stand-alone operation of WECS?
7. Differentiate between fixed and variable speed wind energy conversion systems.
8. List the merits of variable speed wind energy conversion system.
9. State the advantages of fixed speed system over variable speed system.
10. What is the impact of high penetration of wind power in to power grid?
11. Draw the schematic diagram grid integrated PMSG based WECS.
12. What are the demerits of grid integrated WECS?
13. What are the power quality issues that affect wind power integration?
14. What are the major problems related with grid interconnections of WECS?
15. Draw the schematic diagram of grid integrated SCIG based WECS.
16. What are the issues created in grid integrated PMSG based WECS?
17. List out the problems in grid integrated solar system.
18. Draw the I-V characteristics of solar cell.
19. Draw the schematic diagram of grid integrated solarsystem.
20. List out the issues to be addressed while integrating the solar PV systems with grid.

UNIT - V

1. What is the need for maximum power point tracking?
2. What will happen if no load is connected to a solar PV system?
3. What is the need for hybrid energy systems?
4. What is the range of hybrid systems?
5. What are the benefits of the hybrid energy systems?
6. List various types of hybrid energy systems.
7. Write the merits of wind-diesel hybrid system.
8. Name the various types of hybrid energy systems.
9. What are hybrid systems?
10. What are the merits of Hybrid RES over the isolated RES?
11. What are the applications of solar PV system?
12. Draw the schematic diagram of grid interactive solar PV system.
13. List various types of MPPT.
14. Give the merits and demerits of MPPT.
15. Enumerate the importance of MPPT in the operation of a photo voltaic system.
16. What is MPPT?
17. What is the necessity of Maximum power point tracking in PV system?
18. What are the types of pumps used for solar water pumping applications?
19. Draw the schematic diagram of PV-Diesel hybrid system.
20. What are the advantages of PV-Diesel hybrid system.

PART – B

UNIT - I

1. Explain the impact of renewable energy generation on environment in detail.
2. How does environment get affected by the use of the renewable energy? and also discuss GHG emissions from the various energy sources.
3. Discuss the influence of different renewable energy sources with special reference to the global warming context.
4. Describe the consequences of greenhouse effect.
5. Explain the working principle of various types of concentrating solar collectors with neat sketch.
6. Compare the power extraction aspects of solar PV system with wind energy system.
7. Describe various types of wave energy conversion device and explain how to generate electrical power from waves.
8. Describe the principle of generation of Bio gas and mention the factors affecting its generation.
9. Explain the design and principle of operation of general Fuel cell and Fossil Fuel cell.
10. Enumerate the prospects of ocean and biomass energy.
11. What are the types of ocean thermal energy conversion power plants? Describe in detail the Anderson OTEC cycle.
12. What is Hydrogen energy? Explain the operation of Hydrogen energy system with a neat schematic.
13. Explain the following with neat schematic.
    i. Wind energy conversion system
    ii. Energy from the Ocean

UNIT – II

1. Draw the schematic of Permanent Magnet Synchronous generator and explain the construction and principle of operation in detail. Also discuss the characteristics and issues briefly.
2. Explain the principle of operation and constructional features of squirrel cage induction generator with a neat diagram. Analyse the merits and demerits of the above.
3. Explain construction, principle of working and characteristics of IG with neat sketches.
4. Explain the principle of operation of DFIG used for renewable energy conversion.
5. Explain machine capacity factor and capacity utilization factor. Explain the principle of operation of double output induction generator system with neat diagram.
6. Draw the circuit model of self-excited induction generator and explain the methods used for steady state analysis.
7. Explain about DFIG based energy conversion system

8. Explain construction, principle of working and characteristics of SCIG with neat sketches.
9. Explain the analysis of Induction Generator used for Wind Energy Conversion System.
10. Draw the circuit model of PMSG and explain the methods used for steady state analysis.

UNIT – III

1. Explain the converters used for solar energy conversion.
2. Describe the grid interactive inverters in detail.
3. Explain with neat diagram the philosophy of operation of a solar source fed boost converter.
4. Describe how a three phase line commutated converter is operated as an inverter.
5. Explain the operation of line commutated converter under inversion mode with the help of a neat circuit diagram and necessary waveforms.
6. Write short notes on the grid interactive inverters.
7. Consider a buck boost converter of input voltage E_{dc}=14V. The duty cycle α=0.6 and the switching frequency is 25kHZ. The inductance L=180µH and the filter capacitance C=220µF. The average load current I_o=1.5A. Compute the average output voltage and peak current of the device.
8. A single phase full bridge inverter has a resistive load of R=2Ω and the DC input voltage is E_{dc}=50V. Compute the RMS output voltage at the fundamental frequency, the output power, the average and peak currents of each thyristor and peak reverse blocking voltage of each thyristor.
9. Describe working of AC-DC-AC converter with circuit and wave form for wind energy conversion.
10. Analyse the principle of working of buck-boost converter with time ratio and current limit control. Draw the circuit and necessary waveforms.
11. Describe principle of operation of PWM inverter and describe how it is used for wind energy conversion.
12. Draw the block diagram of the solar PV system and explain the principle of operation in detail.
13. Draw the schematic diagram of Buck-Boost converter and explain the operation in detail.
14. Explain the following in detail:
    i. AC voltage controller
    ii. Voltage control in PWM inverters.

UNIT – IV

1. Explain the stand alone operation of fixed speed wind energy conversion system.

2. Explain the stand alone operation of variable speed wind energy conversion system.
3. Explain the block diagram of SCIG based wind energy conversion system.
4. Explain the operation of grid integrated PMSG system with a neat block diagram.
5. Explain with the help of a neat block diagram the functions of various blocks of a WECS.
6. A HAWT is installed at a location having free wind velocity of 15m/s. The 80m diameter rotor has three blades attached to the hub. Find the rotational speed of the turbine for optimal energy extraction.
7. Write short notes on grid integrated solar system.
8. Describe stand alone operation of solar energy conversion system.
9. Discuss in detail the grid system characteristics and explain with a neat diagram the stand alone and grid integrated solar system.
10. Explain how the isolation and temperature affects the I-V characteristics of a solar cell.
11. Explain about various grid connection issues and its impact on system stability.

UNIT – V

1. Explain the hybrid energy conversion system with neat sketch.
2. Derive an expression for the total cost of a hybrid system and three from deduce a simple condition for the feasibility of the system.
3. Explain MPPT techniques for WECS.
4. Explain various strategies used for the operation of an MPPT.
5. Is wind energy an excellent supplement to the PV? If so justify with a suitable case study.
6. What is MPPT? Discuss the types of MPPT with its merits and demerits. Explain the incremental-conductance algorithm with a neat example.
7. Explain operating principle of PV Maximum Power Point Tracking in energy conversion.
8. Explain with case study how to get maximum power generation in wind energy conversion system.
9. With a neat sketch, explain the operation of PV-Diesel hybrid system.
10. Draw and explain the operation of Wind-PV hybrid system.