Code No: 156EA **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, July - 2023
RENEWABLE ENERGY SOURCES
(Common to CE, ME, ECE)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A and Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a and b as sub-questions.

PART – A

(25 Marks)

1.a) Write five factors that are considered while defining a site for wind power generation. [2]
b) What are the primary sources for converting grid electricity? [3]
c) Differentiate between fuel cells and automobile batteries. [2]
d) Draw an equivalent electrical circuit, with appropriate labeling, of n identical PV cells connected in i) series and ii) parallel. [3]
e) Write the equation for the per-phase impedance of an induction generator seen from terminals. Also, write the Thevenin impedance of the same. [2]
f) Derive the equation of torque in a 3-phase induction generator. [3]
g) Write the equations of energy used for pumping a volume V of water up to a height h with pumping efficiency η_p and energy supplied to the grid while generating with efficiency η_g. [2]
h) What are ultra-capacitors? [3]
i) Draw the phasor diagrams of grid-connected voltage source inverter for i) voltage-controlled VSI; ii) current-controlled VSI. [2]
j) Mention three advantages of a grid-connected induction generator. [3]

PART – B

(50 Marks)

2.a) Mention the factors governing the integration of electricity generated from renewables into grid supplies.
b) Derive the equation of wind power mechanical capacity. [4+6]

OR

3.a) Discuss in brief about use of modern electronic controls in power systems.
b) Explain wind speed analysis by visualization. [5+5]

4.a) Derive the equation of the conversion efficiency of a PV cell for maximum power. (Assume incident flux power is P_i)
b) Explain the concept of a reversible fuel cell. [6+4]

OR

5.a) Draw the equivalent circuit of the fuel cell along with related equations.
b) Write in brief about the economic analysis of solar energy. [6+4]

6. Describe the concept of a self-excited induction generator along with a mathematical description of self-excitation. [10]

OR

7.a) Draw the torque-speed characteristics of the induction generator with control variables as i) stator voltage; ii) rotor voltage; iii) stator-rotor voltage phase shift; iv) rotor resistance; v) rotor reactance; and vi) stator voltage frequency.

b) Write a short note on the interconnected operation of the induction generator. [6+4]

8. What are the energy storage parameters for distributed generation? [10]

OR

9. Write short notes on:
a) Compressed air energy storage
b) Energy storage as an economic resource. [5+5]

10.a) Write the advantages of dc-link integration.

b) What is National Electrical Code? Elaborate. [5+5]

OR

11.a) Discuss a small grid-connected PV system as an interconnection example for alternative energy sources.

b) What are the disadvantages of an HFAC microgrid system? [5+5]

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