

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) END SEMESTER ON-LINE PROCTORED EXAMINATIONS

DECEMBER 2021

RENEWABLE ENERGY [ELE 4086]

REVISED CREDIT SYSTEM

Time: 75 Minutes + 10 Minutes	Date: 22 December 2021	Max. Marks: 20

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Time: 75 minutes for writing + 10 minutes for uploading.
- **1A.** What is the function of DC-DC converter in PV systems and derive the relation for equivalent input impedance (i.e. Req) as seen by the DC-DC converter by considering Buck and Buck-Boost converter separately. Also, explain the movement of operating point on I-V characteristics with respect to the converter duty cycle.

If a PV module with $V_{OC} = 36V$, $I_{SC} = 2A$, $V_{MPP} = 30V$, and $I_{MPP} = 1.8A$ is connected to buck-boost converter (η =90%) with load resistance of 10 ohm. Determine the duty cycle of the converter to operate at MPP.

1B. A propeller type wind turbine has the following data: Speed of free wind at a height of 10 m is 12 m/s, Air density= $1.226kg/m^3$, alpha= 0.14, Height of tower is 90m, Diameter of wind turbine rotor is 60 m, wind velocity at the turbine reduces by 25%, Determine the maximum power extracted by the wind turbine (in MW).

If a HAWT is installed at a location having free wind velocity of 20 m/s. The 70-m diameter wind turbine rotor has three blades attached to the hub. Find the rotational speed of the turbine (in RPM) for optimal power extraction. (04)

(03)

1C. Design a standalone distributed energy system comprising of Renewable Energy sources with the following specifications: Load profile parameters: $P_{dem, min} = 1 MW, P_{dem, max} = 10 MW$, $\overline{P}_{dem} = 7 MW_{I}$ $K_{cf wtg} = 16\%_{I}$ $K_{cf PV} = 10\%$ are the capacity factors of wind turbine generator and Photovoltaic system respectively. Assume that the system is operating with photovoltaic, wind energy conversion system and battery bank as an energy storage.

i) If $P_{PV,rated} = 30 MW$, what should be the rated power of Wind energy conversion system (WECS)?

ii) For the generation of the rated power from WECS, how many 1000 kW wind turbine generator units are required?

iii) What is the maximum possible excess power generated by considering the given capacity? (03)

- 2A. The following data are given for a family biogas digester suitable for the o/p of 8 cows; The retention time is 25 days, temp is 30° c, dry matter consumed per day is 2 kg, biogas yield is $0.24m^3$ per kg. The efficiency of the burner is 65%, methane proportion is 0.7. Heat of combustion of methane is 28 MJ/m^{3.} Find the energy generation and volume of the digester.
- 2B. Compare & discuss the Vapour dominated or drv steam fields & Liquid dominated or wet steam fields. Describe the working principle of Flash steam open systems for power generation from the geothermal energy with a neat figure. (03)
- 2C. Compare & discuss open & closed cycle ocean thermal energy conversion (OTEC) systems. Also, with a neat diagrams explain the working principle OTEC System which comprises the advantages of both open and closed cycle systems.

(03)

(04)