Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **B. Tech**
REL5D005

5th/7th Semester Regular/Back Examination: 2025-26
RENEWABLE POWER GENERATION SYSTEMS
CSE, CSEAI, CSEAIML, CSEDS, CST, EEE, ELECTRICAL
Time: 3 Hours
Max Marks: 100
Q Code: U403
Answer all questions of Part-A, any 08 questions of (Part-B) and any two from Part-C.
The figures in the r
Right-hand margin indicate marks.

Part- A

Q1 **Objective Answer Type Questions (Answer All)** **(02x10)**

a) Define dispersed generation (DG) and give one example.
b) What is solar insolation? Briefly explain.
c) A 300 W photovoltaic module contains 72 series-connected cells, arranged as three strings of 24 cells each, with one bypass diode per string. Under STC (1000 W/m²), the module produces its rated power. If one string is shaded such that its irradiance drops to 200 W/m², while the other two strings receive full irradiance, estimate the new maximum power output of the module.
d) A solar cell is basically a current source, controlled by flux of radiation: True or False. Comment with justification.
e) What is a tip-speed ratio in wind turbines?
f) List two differences between induction and synchronous generators used in wind turbines.
g) State any two methods used for reactive power compensation in wind energy systems.
h) What is anaerobic digestion, and how is it used in biogas production?
i) What is pyrolysis? Briefly explain.
j) Mention two advantages of electric vehicles.

Part- B

Q2 **Focused-Short Answer Type Questions- (Answer Any Eight)** **(06x08)**

a) Explain the concept of distributed energy systems and dispersed generation (DG). Discuss their advantages and challenges in the context of renewable energy integration.
b) Explain about Solar Cell, Solar PV Module, Solar PV Panel and Solar PV Array.
c) Describe the different types of solar collectors used in thermal systems. Discuss their performance characteristics and typical applications.

d) Explain the effect of partial or complete shadowing on a solar cell in a PV module.

e) What do you mean by pitch angle? How pitch angle can be controlled in wind energy conversion system.

f) Explain the aerodynamic principles governing wind rotor operation.

g) Determine the maximum power a wind turbine may produce at the following wind speeds: 1, 5 and 10 m/s. Assume Betz limit as 0.593 and air density (approximately 1.225 kg/m³ at sea level).

h) Compare and contrast grid-connected and self-excited induction generators in wind energy systems.

i) Describe the process of biomass pyrolysis.

j) Describe anaerobic digestion with a neat diagram. Explain the design considerations for biogas digesters.

k) Why reactive power compensation is required in wind firms and how is it provided? Explain.

l) Compare the technical features of hybrid electric vehicles (HEVs) and battery electric vehicles (BEVs).

Part-C

Long Answer Type Questions (Answer Any Two)

Q3 **(8+8)**

(a) Explain, what is maximum power point tracking (MPPT) in PV system?

(b) Discuss solar thermal applications: water heating, space heating, and solar cookers.

Q4 **(10+6)**

(a) Explain in detail the layout and working of wind electricity generation power plant.

(b) With diagrams, explain the operation of DFIG-based wind energy systems and discuss reactive power compensation.

Q5 What is biomass energy? State the advantages and disadvantages of Biomass energy. Explain the process of commercial production of ethanol from biomass. **(2+6+8)**

Q6 **(10+6)**

(a) Explain with a neat schematic the working of a Diesel–PV hybrid system.

(b) A hybrid system consists of a PV array (1.2 kW at STC) and a wind turbine (rated 1.5 kW at 12 m/s). If irradiance is 700 W/m² and wind speed is 8 m/s (turbine output at 8 m/s = 40% of rated), calculate:
(i) PV output power
(ii) Wind output power
(iii) Total hybrid system output.

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