Name: Enrolment No:	UPES UNIVERSITY OF TOMORROW

SECTION A
10Qx2M=20Marks
Note – Fill in the Blanks (One word answer)

S. No.		Marks	CO
1	What is the primary advantage of renewable energy resources compared to fossil fuels? A. Higher energy density B. Lower initial cost C. Reduced environmental impact D. Easier storage	**[2]**	**CO1**
2	Which country is currently the global leader in solar power capacity? A. United States B. China C. Germany D. India	**[2]**	**CO1**
3	Which of these renewable resources is primarily used for generating electricity in areas with volcanic activity? A. Biomass B. Geothermal C. Wind D. Hydropower	**[2]**	**CO1**
4	What is the main barrier to the widespread adoption of renewable energy technologies in many countries? A. Lack of scientific knowledge B. High installation costs and infrastructure requirements C. Low efficiency of renewable sources D. Scarcity of renewable resources	**[2]**	**CO1**

5	Which energy storage technology is often paired with renewable energy sources to ensure a stable energy supply? A. Nuclear reactors B. Thermal storage C. Batteries D. Biomass gasifiers	**[2]**	**CO1**
6	Which renewable energy source has the highest growth rate globally due to declining costs and increased efficiency? A. Solar B. Biomass C. Hydropower D. Geothermal	**[2]**	**CO1**
7	The term "grid parity" refers to: A. When renewable energy reaches the same cost as fossil fuels for electricity generation B. When all energy sources contribute equally to the grid C. The balance of energy generation and consumption D. A target capacity for renewable energy on the grid	**[2]**	**CO1**
8	Which of the following factors most directly affects the Levelized Cost of Energy (LCOE) for renewable energy projects? A. Fuel costs B. Carbon tax rates C. Capital investment costs D. Government subsidies for fossil fuels	**[2]**	**CO1**
9	The economic feasibility of solar and wind energy projects has improved significantly over recent years due to: A. Rising costs of fossil fuels B. Advancements in energy storage technology C. Declining capital costs for equipment D. Introduction of carbon taxes	**[2]**	**CO1**
10	Which economic measure is often used to evaluate the long-term profitability of a renewable energy project? A. Payback Period B. Net Present Value (NPV) C. Simple Interest Rate D. Carbon Offset	**[2]**	**CO1**

SECTION B 4Qx5M= 20 Marks			
Q11	What are the major roadblocks to India's Renewable Energy Transition?	**[5]**	**CO2**
Q12	Why do governments provide subsidies for renewable energy? How do these subsidies help reduce costs?	**[5]**	**CO2**
Q13	What are the regulatory and policy factors for the renewable energy development in the country?	**[5]**	**CO2**
Q14	List three economic benefits of using renewable energy compared to fossil fuels.	**[5]**	**CO2**
SECTION-C 3Qx10M=30 Marks			
Q15	A renewable energy company uses exponential smoothing to forecast daily solar power generation. If the actual generation on Day 1 was 100 MW and the forecast was 95 MW, calculate the forecast for Day 2 using a smoothing factor (α) of 0.2. Discuss how the choice of the smoothing factor impacts the accuracy and responsiveness of the forecasting model in the context of renewable energy variability.	**[10]**	**CO3**
Q16	A solar power plant and a wind farm supply electricity to a grid. The maximum demand from the solar power plant is 50 MW, while the wind farm's maximum demand is 70 MW. However, their combined maximum demand on the grid at any point in time is 100 MW. Calculate the diversity factor for these renewable energy sources and discuss its significance in optimizing grid capacity planning for renewable energy integration.	**[10]**	**CO3**
Q17	A biomass power plant consumes 500,000 kg of biomass fuel per day with a calorific value of 3,200 kcal/kg. The plant generates 40 MW of electricity and operates for 24 hours a day. Calculate the heat rate of the plant in kcal/kWh and interpret the result. Additionally, explain how improving the heat rate can impact the cost-effectiveness and sustainability of biomass-based power generation.	**[10]**	**CO3**
SECTION-D 2Qx15M= 30 Marks			

The electricity tariff calculation for a 10 MW solar PV plant in Rajasthan involves several key factors, including capital costs, operation and maintenance (O&M) expenses, debt servicing, and desired returns on investment. The plant is expected to operate for 25 years with a capacity utilization factor (CUF) of 20%, generating 17,520 MWh annually. The total capital cost of the plant is ₹45 crore, with 70% of the cost financed through debt and 30% through equity. The annual debt servicing cost is ₹5.13 crore, based on an 8% interest rate and a 10-year repayment period. Additionally, the plant incurs ₹1 crore annually in O&M costs. To ensure financial viability, the total annual revenue requirement, covering debt servicing, O&M costs, and a 15% return on equity (₹2.025 crore), amounts to ₹8.155 crore.

To calculate the tariff, the total annual revenue requirement is divided by the total annual energy generation, resulting in a tariff of ₹4.65 per kWh. This tariff ensures that the plant can cover its costs, provide a reasonable return on investment, and remain financially sustainable over its 25-year operational life. The calculation highlights the importance of balancing capital and operational costs, financing structure, and expected returns to determine a tariff that supports both the developers' financial goals and the economic feasibility of the project. This tariff plays a crucial role in negotiations with utilities and helps ensure the long-term success of the solar PV plant.

CO 4

Q 18 - How does the capital cost structure (debt vs. equity financing) impact the tariff calculation for a solar PV plant? Explain the role of return on equity and debt servicing in determining the electricity tariff for a solar power project.

Q 19 - What are the key factors that a solar PV plant developer should consider when determining the electricity tariff for a project, and how can these factors influence the financial viability and competitiveness of the plant in the renewable energy market?