U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

July 2023 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: ES – Cluster Elective **Duration: 3 hrs.**
Course Code: 19EE6CE1WS **Max Marks: 100**
Course: Wind and Solar Energy Systems **Date: 19.07.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	CO	PO	Marks
1	a)		Represent the flow of renewable energy and conventional energy with the help of diagrams and explain the differences between them	*CO1*	*PO7*	**08**
	b)		Discuss the possible control options that can be incorporated in order to match the renewable energy supply with the load	*CO1*	*PO7*	**06**
	c)		What is Energy Planning? Why is it essential?	*CO1*	*PO7*	**06**
			UNIT - II			
2	a)		With relevant diagrams, define 1) Hour Angle 2) Zenith Angle.	*CO2*	*PO2*	**05**
	b)		List the devices used for the measuring solar radiation. Explain with neat diagrams the working of an instrument used for total solar radiation (ANY ONE Type).	*CO2*	*PO2*	**07**
	c)		Calculate the sunrise time sunset time and day length hours in Bangalore (12.97°N, 77.59°E) on 25th April.	*CO2*	*PO2*	**08**
			OR			
3	a)		What are Sun path diagrams? Explain how they can be used in the design of solar PV systems?	*CO2*	*PO2*	**05**
	b)		What is declination angle? Explain the consequences of variation in declination angle on solar insolation received on earth. Explain with neat diagrams	*CO2*	*PO2*	**07**
	c)		Find the clear sky insolation on a collector at solar noon on summer solstice for i) single axis tracking ii) two axis tracking in a place having a latitude of 12.97°N. (Consider Optical Depth k=0.205, Apparent Extraterrestrial Flux A= 1088W/m^2 and Sky Diffuse Factor C=0.134)	*CO2*	*PO2*	**08**
			UNIT - III			
4	a)		Sketch and explain the I-V curve and power output of a PV module? What is the impact of solar insolation and temperature on the I-V curves?	*CO2*	*PO2*	**10**

		b)	Give the classification of PV cells based on the technologies used for manufacturing processes.	*CO2*	*PO2*	**04**
		c)	A 36-cell PV module has a parallel resistance per cell of Rp=6.6 ohms. In full sun and at a current of 2.14A, the output voltage was found to be 19.41A. With one cell shaded and assuming the current to be constant i) what would be the new module voltage and power? ii) what would be the voltage drop across the cell iii) how much power would be dissipated in the shaded cell? Take the value of Rs =0.005ohm.	*CO3*	*PO3*	**06**
			UNIT - IV			
	5	a)	With neat diagrams, explain the Grid connected PV system? Mention its advantages	*CO3*	*PO3*	**06**
		b)	What is the importance of load curves with respect to a PV application? Sketch 3 important load curves and briefly explain.	*CO3*	*PO3*	**10**
		c)	A nearly depleted 12-V lead-acid battery has an open-circuit voltage of 11.5 V and an internal resistance of 0.035ohms. a.) What voltage would a PV module operate at if it is delivering 5 A to the battery? b.) If 15 A is drawn by a load from a fully charged battery with open-circuit voltage 12.7 V, what voltage would the PV module operate at?	*CO3*	*PO3*	**04**
			OR			
	6	a)	With neat diagrams, explain the stand-alone PV system? Mention its advantages.	*CO3*	*PO3*	**06**
		b)	Explain what is peak hours approach to estimate the PV performance.	*CO3*	*PO3*	**10**
		c)	A PV array rated at 1 kW under standard test conditions. Module nominal operating cell temperature (NOCT) is 47° C. DC power output at the MPP drops by 0.5%/° C above the STC temperature of 25° C. Estimate its ac output under PTC conditions, (ambient temperature of 20° C, insolation S = 1 kW/m^2) if there is a 3% array loss due to mismatched modules, dirt loss is 4%, and the inverter has an efficiency of 90%.	*CO3*	*PO3*	**04**
			UNIT - V			
	7	a)	How are wind turbines classified? Explain with neat diagrams. Mention their merits and demerits.	*CO4*	*PO3*	**10**
		b)	Describe with a neat block diagram the components of a wind to electric conversion system.	*CO4*	*PO3*	**06**
		c)	How maximum blade efficiency can be obtained with changing wind speeds?	*CO4*	*PO3*	**04**

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