

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11.	a) Discuss the types of wind energy systems, their control strategies, and the importance of the operating area in maximizing energy output. (OR)	13	K2	CO1
	b) Explain the process of electric power generation from fuel cell and Ocean energy.	13	K2	CO1
12.	a) How does a DC to DC converter help in maximum power transfer? Explain any one MPPT algorithm. (OR)	13	K3	CO2
	b) Explain the various control techniques used in solar PV systems for power extraction and grid integration. Include an explanation of voltage and current control methods, and how control algorithms help in maintaining system stability and maximizing power output.	13	K3	CO2
13.	a) Describe the operation of a Doubly Fed Induction Generator (DFIG) in wind energy systems. How does it maintain constant frequency output over variable wind speeds? (OR)	13	K3	CO3
	b) Compare and contrast SCIG, DFIG, and PMSG in terms of construction, working principle, and application in renewable energy systems.	13	K3	CO3
14.	a) Explain the stand-alone operation of fixed-speed and variable-speed Wind Energy Conversion Systems (WECS) and discuss the challenges of operating a SCIG in stand-alone mode. How are these challenges addressed in practice? (OR)	13	K2	CO4
	b) Describe how a PMSG-based WECS operates both in stand-alone and grid-connected modes.	13	K2	CO4
15.	a) Draw and explain the block diagram of a small hydro power station, and explain the power estimation method of a hydropower plant. (OR)	13	K2	CO5
	b) What is SCADA and ICCS (Integrated Computer Control System)? Explain its application in the automation of hydro power plants.	13	K2	CO5

PART – C

(1 x 15 = 15Marks)

- | Q.No. | Questions | Marks | KL | CO |
|--------|---|-------|----|-----|
| 16. a) | Design isolated solar PV system where in the ac loads consists of CFL, TV, fan, refrigerator and a computer. The system should allow the use of loads in non-sunshine hours with one day of autonomy. | 15 | K2 | CO1 |

Inverter efficiency and DC/DC converter efficiency range: 97%
 Battery capacity : 40 Ah @ 12V, 70% DOD, efficiency : 90 %
 Solar panel: 100 W, 5.56A(I_{mp}), 6.28A(I_{sc}), 22V(V_{oc}), 18V(V_{mp})

S.No	Load	Watts	Hrs/day	Number
1	LED	12	10	8
2	Fan	40	5	4
3	TV	150	5	1
4	Refrigerator	400	10	1
5	Computer	200	1	1

Note: Assume suitable data if necessary

(OR)

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|----|--|----|----|-----|
| b) | A household has an average daily energy consumption of 18 kWh/day. They want to install a rooftop solar PV system that can meet 100% of their energy needs. The location receives an average solar insolation of 5.5 kWh/m ² /day. Design a grid-connected rooftop solar PV system to meet this load. | 15 | K4 | CO2 |
|----|--|----|----|-----|

Following is the given data: Energy consumption = 18 kWh/day
 Solar insolation = 5.5 kWh/m²/day ; PV panel efficiency = 16%
 Performance ratio (PR) = 0.75 (to account for system losses)
 Module capacity = 330 Wp per panel ; Inverter efficiency = 95%
 Find:

- i. Total system size required (in kWp)
- ii. Number of PV modules required
- iii. Rooftop area needed (in m²)
- iv. Inverter rating (in kW)

Note: Assume suitable data if necessary