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Question Paper Code : X 86077

M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Elective
Electrical Drives and Embedded Control
PS 5092 – SOLAR AND ENERGY STORAGE SYSTEMS
(Common to M.E. Power Electronics and Drives/M.E. Power Systems Engineering)
(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Define fill factor (FF).
2. State the principle of solar PV energy conversion.
3. What is the effect of partial or complete shadowing of a cell in module ?
4. Differentiate between cell, module and panel.
5. What is Jawaharlal Nehru National Solar Mission ?
6. Distinguish standalone system and a grid-connected solar PV system.
7. List the standard parameters of a battery specified by the manufactures.
8. In battery function, what is cut-off voltage ?
9. Why to connect batteries together for a given application ?
10. List the advantages of solar water pumping system.

PART – B

(5×13=65 Marks)

11. a) i) With neat sketches, explain the mechanism of photoconduction in a PV cell. (8)
ii) List the strength and weakness of a solar PV system. (5)

(OR)

- b) Explain the various types of solar cells based on material thickness and the type of junction structure.



12. a) A solar cell having an area of 100 cm^2 gives 3.1 A current at maximum power point and 0.5 V at maximum power point at STC. The cell gives 3.5 A short circuit current and 0.6 V open circuit voltage. What is the maximum power point of the solar cell ? Also find out the efficiency of the cell.

(OR)

- b) Discuss the various steps involved in designing of standalone PV system.

13. a) With the help of block diagrams explain the operations of grid connected SPV system.

(OR)

- b) i) Elaborate on design procedures followed in grid-connected SPV power plants. (8)

- ii) If PV meter reads 10 kWh and load meter reads 8 kWh , what will be the net energy meter reading ? (5)

14. a) With examples and neat sketches discuss in detail about the function of primary and secondary batteries.

(OR)

- b) A discharged 12 V battery is charged for 10 hours at 12 A , the average charging terminal voltage being 14.5 V . When connected to a load for discharging current of 10 A is drawn for 10 hours at an average terminal voltage of 12 V . calculate the ampere-hour and watt-hour efficiency.

15. a) How do you use solar power in a car ? Discuss the technical challenges raised while designing of solar power car.

(OR)

- b) i) With suitable diagram explain the function of direct coupled solar pumping system. (8)

- ii) Discuss the need of solar power for telecommunication applications. (5)

PART – C

(1×15=15 Marks)

16. a) A photovoltaic system is installed for supplying water for minor irrigation plant needs at a remote place in a developing country. The water is pumped through a borewell from a depth of 25 m . The PV array consists of 24 modules. Each module has 36 multicrystalline silicon solar cells arranged in 9×4 matrix. The cell size is $125 \text{ mm} \times 125 \text{ mm}$ and the cell efficiency is 12% . The combined motor and pump efficiency is 50% Calculate the water discharge rate at noon when global radiation incident normally to the panel is 800 W/m^2 . Assume water density as 996 kg/m^3 .

(OR)

- b) Discuss in detail about the need and function of Solar thermal energy storage and pumped hydroelectric energy storage.
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