B.E. Electrical VII CBGS

A - 402 - 20
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17.12.15

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Elective-I Renew E & Syst. Storage

QP Code : 6136

Duration: 3 hours **Max marks: 80**

N.B.: 1. **Q. 1 is compulsory**
2. Answer **any three** out of remaining **five** questions
3. Assumptions made should be clearly stated
4. Assume any suitable data wherever required but justify the same
5. Use graph paper wherever necessary

Q.1 Answer **any four** of the following (20)

(a) State and compare various renewable energy sources. What is the possibility of mitigating the problems faced due to fossil fuels with integration of renewable energy?

(b) Compare mono-crystalline, poly-crystalline and thin film solar PV technology. State the effect of mismatch in modules on Solar PV system performance

(c) Explain the concept of maximum power point tracking (MPPT) in solar PV? Explain the working principle of the "Perturb and Observe" MPPT algorithm with the help of suitable diagrams.

(d) Describe the working principle Fuel cell and its electrical characteristics.

(e) If a roof top solar PV system of 20kWp is installed in city like Mumbai, how much energy yield (generation in kWHr) can be expected in a year? Justify the answer with suitable calculation and assumptions.

(f) What is the importance of energy storage systems in renewable energy applications? Justify your answer with the help of suitable examples.

Q.2 (a) Assume that a 3 phase 415 volts solar PV grid connected system has to be designed for a 75 kWp. If the solar PV panels to be use are of P_{mp}= 250Wp, V_{mp}= 29 V and I_{mp}= 8.62A at STC, calculate the numbers of series and parallel combination of the solar PV panels need to be used. (06)

(b) Assume that for a certain operating conditions, a solar PV module has its maximum power point at P_{mp}= 250Wp, V_{mp}= 29 V and I_{mp}= 8.62A. What is means by which we can extract the maximum power? Suggest a dc-dc converter suitable to be used as MPPT converter if the PV module is delivering power to a 15Ω resistance? Calculate the duty cycle at MPPT. (06)

(c) For a single phase standalone solar PV system with battery backup is to be designed for a residential application which has average electricity consumption of 20 units (kWhr/day). Calculate (i) solar PV array capacity (ii) number of series and parallel SPV modules if poly-crystalline PV panels of P_{mp}= 250Wp, V_{mp}= 29 V and I_{mp}= 8.62A at STC are used (iii) Area occupied by solar PV array (iv) 12 volts lead acid battery storage capacity in AHr (ampere hour) and WHr. Assume suitable data if needed. (08)

Q.3 (a) Explain the working of Wind Energy System (WES) with reference to the following: (14)
(i) Different components of WES (ii) Types of wind turbine
(iii) Wind turbine characteristics (iv) Types of electrical generators used in WES
(v) Power convertor topologies used for WES

(b) Describe the operating principle of wave energy generation. Compare it features with Tidal energy system. (06)

Q.4 (a) Draw I-V (current v/s voltage) characteristics of a solar PV panel with V_{mp}= 29 V and I_{mp} = 8.62 A at 1000W/m^2 (at STC) and clearly mark all essential parameters on it. (06)

(b) Describe various types or forms of energy storage which are commonly used in renewable energy system and compare their performance. What type of energy storage is suitable for hybrid combination with (i) solar PV source (ii) Fuel cell source? Justify your answer. (14)

Q.5 (a) What is partial shading problem in solar PV system? What are the means and ways by which it can be mitigated? (10)

(b) Draw and describe any one hybrid power system based on renewable energy sources and energy storage. (10)

Q.6 Describe the following with the help of suitable examples and diagrams **(Any Three)** (20)
(a) Solar thermal energy systems
(b) Solar PV Micro-inverters
(c) Applications of energy storage in electric and hybrid vehicles
(d) Future trends in power generation and distribution

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