

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: B.TECH  
BRANCH: EEE**

**SEMESTER : VI  
SESSION : SP/2023**

**SUBJECT: EE365 INTRODUCTION TO SUSTAINABLE ENERGY**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|---|-----|----|----|
| Q.1(a) Discuss different renewable sources of energy with special reference to Indian context.  | [5] | 1  | 2  |
| Q.1(b) With the help of single diode model explain the different losses in a solar photovoltaic cell.   | [5] | 2  | 2  |
| Q.2(a) Discuss and draw the i-v characteristics along with power curve for two non-identical PV cells connected in series without and with protection measures. | [5] | 2  | 2  |
| Q.2(b) A Solar cell has the following parameters at standard test conditions of 1000 W/m <sup>2</sup> and 25 <sup>o</sup> C:                                    | [5] | 2  | 5  |

| Open circuit voltage ( $V_{oc}$ ) | Short circuit current ( $I_{sc}$ ) | Fill Factor (FF) | Temp. Coeff. for $V_{oc}$ | Temp. Coeff. for $I_{sc}$ | Temp. Coeff. for max power |
|-----------------------------------|------------------------------------|------------------|---------------------------|---------------------------|----------------------------|
| 0.6 V                             | 35 mA/cm <sup>2</sup>              | 78%              | -0.34%/k                  | +0.045 %/k                | -0.47%/k                   |

Determine the value of  $V_{oc}$ ,  $I_{sc}$  and FF at 1000 W/m<sup>2</sup> and 30<sup>o</sup>C.

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|---|-----|---|---|
| Q.3(a) Explain different components of a wind turbine with suitable diagram.  | [5] | 3 | 2 |
| Q.3(b) A 100Ah, 5V lead acid battery having c-rate is C20, has an internal resistance of 1.0 Ohms at a DoD level of 0%. Now if the C20 battery is being used for C10 rating, let the discharge current increases by 20 %. Determine the battery terminal voltage when the battery is at the DoD level of 80%. | [5] | 4 | 5 |
| Q.4(a) Describe the steps for deciding the PV array size for an application considering the days of autonomy and recharge with example.   | [5] | 4 | 2 |
| Q.4(b) Design a buck converter based current controlled scheme for battery charger.   | [5] | 5 | 6 |
| Q.5(a) Explain different energy storage methods with suitable diagram.  | [5] | 4 | 4 |
| Q.5(b) Explain one of the MPPT control strategy and also analyze the operation of DC-DC converter in MPPT control.  | [5] | 5 | 4 |

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