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

CLASS: B.TECH   SEMESTER : VI
BRANCH: EEE   SESSION : SP/2024

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.

			CO	BL
Q.1(a)	Discuss different renewable sources of energy with special reference to Indian context. List out the advantages and disadvantages of conventional & non-conventional energy source?	[5]	1	2
Q.1(b)	Explain mechanism of photoconduction in a PV cell?	[5]	2	2
Q.2(a)	Discuss and draw the i-v characteristics along with power curve for three non-identical PV cells connected in parallel without protection measures.	[5]	2	2
Q.2(b)	A Solar Panel consists of 5 x 6 identical cells (connected in series) and similar 4 sets are connected in parallel with protection scheme, each cell has the following parameters at standard test conditions of 1000 W/m^2 and 25^0 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^2	78%	-0.34%/k	+0.045 %/k	-0.47%/k

Determine the value of V_{oc}, I_{sc} and FF at 800 W/m^2 and 30^0 C. In order to directly connect this PV panel with a lead acid deep discharge battery, analyze the battery parameters such as nominal voltage, maximum charge current limit and C-rate.

Q.3(a)	Explain different parts of a wind energy panels and their working with suitable diagram.	[5]	3	2
Q.3(b)	A number of 100Ah, 5V lead acid batteries are available in the c-rates of C20, C10, C5, and 2C. For the given load pattern of Load 1: 60 W day and night continuous at 40 V DC. Load 2: water pump: 5 times daily for 1 hr. duration each time, the slots are: two times before sunrise, one at noon and 2 times after sunset. The load has an average running current of 4 A at 40 V DC. Depending upon the load profile, determine the suitable c-rate of the battery.	[5]	4	5
Q.4(a)	Analyze the operation of a Boost converter-based dc-dc power interface used for MPPT control of a PV module with suitable sketch and waveforms with their limitations.	[5]	4	2
Q.4(b)	Design a PV emulator with the help of switched mode dc-dc converter.	[5]	5	6
Q.5(a)	Discuss the operation behind the grid connection in order to transfer power at unity power factor for a given PV module with complete schematic.	[5]	4	4
Q.5(b)	Design a buck converter based current controlled scheme for battery charger.	[5]	5	4

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