Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2018

Course: Solar Energy Technology (ETEG 304) **Semester: V**
Program: Int. B. Tech.
Time: 03 hrs. **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
Q 1	Calculate declination angle for March 31 in a leap year.	**4**	**CO1**
Q 2	Explain the working of 'two-pass air heater with porous medium' with help of diagram.	**4**	**CO2**
Q 3	Discuss important parts of liquid flat plate collector	**4**	**CO2**
Q 4	Briefly explain "solar passive space heating".	**4**	**CO4**
Q 5	Calculate fill factor for a solar cell which has following parameters: V_{oc} = 0.21 V, I_{sc} = -5.5 mA, V_{MP} = 0.125 V, I_{MP} = - 3 mA	**4**	**CO5**
	SECTION B		
Q 6	Describe a central receiver system using a molten salt as a heat transfer fluid.	**10**	**CO4**
Q 7	A solar air heater is used for heating ambient air in a particular application. The characteristic parameters of the air heater are $FR_{(\tau\alpha)_{av}} = 0.63$, $F_R U_l = 6.2$ W/m^2-K.If the solar flux incident on the plane of the collector is 705 W/m^2, calculate the useful heat gain rate.	**10**	**CO2, CO4**
Q 8	With the help of block diagram, explain the operations of grid interactive SPV system.	**10**	**CO5**
Q 9	With help of diagram discuss following situations for using a thermal energy storage: (i) Buffer storage (ii) Diurnal storage (iii) Annual storage	**10**	**CO3**
	SECTION-C		
Q 10	Calculate total radiation at an inclined surface, facing due south, tilted at 30° with horizontal at a location in a city, with latitude 28.85° on January 1 at 12 noon (solar time). The reflection coefficient of the ground is 0.2.	**20**	**CO1**
Q 11	With the help of diagram, explain the working of Natural circulation solar water heater (pressurized). **OR** Clearly explain the construction of a p-n junction and its use to convert sunlight directly into electricity. What distinguishes a solar cell from a conventional p-n junction diode?	**20**	**CO5** **CO4**

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Name of Examination (Please tick, symbol is given)	:	**MID**		**END**	☒	**SUPPLE**	
Name of the College (Please tick, symbol is given)	:	**COES**	☒	**CMES**		**COLS**	
Program/Course	:	**Int. B.Tech. – ET + IPR**					
Semester	:	**V**					
Name of the Subject	:	**Solar Energy Technology**					
Subject Code	:	**ETEG 304**					
Name of Question Paper Setter	:	**Dr. Madhu Sharma**					
Employee Code	:	**40000357**					
Mobile & Extension	:	**9410133924 / 1427**					
Note: Please mention additional Stationery to be provided, during examination such as Table/Graph Sheet etc. else mention "NOT APPLICABLE":							

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Note: - Pl. start your question paper from next page

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SECTION A

S. No.		Marks	CO
Q 1	Calculate the zenith angle for air mass 1.5.	**4**	**CO1**
Q 2	Explain the working of 'matrix air heater' with help of diagram.	**4**	**CO2**
Q 3	Discuss different types of losses that take place in a flat plate collector.	**4**	**CO2**
Q 4	Briefly explain "solar greenhouse".	**4**	**CO4**
Q 5	For a typical PV cell, the following performance parameters are obtained from the I-V characteristics: $V_{oc} = 0.611$, $I_{sc} = 2.75$, $V_{MP} = 0.5$, $I_{MP} = 2.59$ Calculate fill factor of the cell.	**4**	**CO5**
	SECTION B		
Q 6	Give a neat diagram of a central tower receiver power plant and explain its operation.	**10**	**CO4**
Q 7	Determine the size of the heating array from the following factors : i. The daily heating needs of a home during the heating season are 100 kW-hr/day. ii. The available daily insolation on the array is 4 kW-hr/m^2 day. iii. Also assume that each panel has an area of 1.5 m^2, an efficiency of 50 per cent, and that one third of the heating will come from auxiliary heaters.	**10**	**CO2, CO4**
Q 8	A solar cell array is required to deliver 100W peak output at 120V DC bus voltage. The solar cells to be used are rated for 0.1W peak output at 0.4V. Design the array, assuming there is no assembly losses.	**10**	**CO5**
Q 9	With the help of diagram explain arrangements of spaces and tubes in container for latent heat storage.	**10**	**CO3**
	SECTION-C		
Q 10	Determine the sunset hour angle for Allahabad (longitude 81°58′E, latitude 24°25′N) for following dates: January 1, March22, july15.	**20**	**CO1**
Q 11	Explain in detail the I-V characteristics of a solar cell. **OR** With the help of diagram, explain the working of forced circulation solar water heater.	**20**	**CO5** **CO4**