Name: **Enrolment No:**	

UPES

End Semester Examination, May 2023

Course: Solar Thermal Technology **Semester : IV**

Program: B. Tech (RSEE) **Time : 03 hrs.**

Course Code: EPEG2021 **Max. Marks: 100**

Instructions: Read the questions properly and try to answer in bullet points whereas applicable.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	What are the main advantages of flat plate solar collectors?	**4**	**CO1**
Q 2	Define the concentration ratio of a solar collector.	**4**	**CO2**
Q 3	Explain the limitations of the thermo-mechanical system.	**4**	**CO3**
Q 4	How is the adequate supply of CO_2 maintained in the greenhouse?	**4**	**CO3**
Q 5	What features of Solar Energy make it attractive for use in irrigation water pumps?	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Discuss the principle of a solar collector. How collector coating can be used to improve the performance of a collector?	**10**	**CO2**
Q 7	With the help of a schematic diagram, explain the working of the solar water heating system.	**10**	**CO3**
Q 8	With the help of a schematic diagram, explain the solar process steam system.	**10**	**CO3**
Q 9	Compare the relative merits and demerits of LiBr-water and aqua-ammonia vapor-absorption cooling systems. Or, Draw a schematic diagram of a solar pond based electric power plant with cooling tower and explain its working.	**10**	**CO4**

SECTION-C (2Qx20M=40 Marks)			
Q 10	Following data are given for a flat plate collector: Size of absorber plate= 2.4 m x 1.4 m Absorber plate thickness= 0.18 mm Thermal conductivity of plate material = 360 W/ m-K Number of tubes attached below abs plate = 15 Fluid flow rate = 50 kg/h Water inlet temperature = 40^0C Specific heat of fluid at 50^0C= 4174 J/kg-K Tube to fluid heat transfer coefficient = 200 W/m^2-K Outer diameter of tubes = 15 mm Inner diameter of tubes= 13.8 mm Overall loss co-efficient of the collector= 5 W/m^2-K Average thickness of adhesive = negligible Length of controller = 2.5 m Width of controller= 1.5 m Ambient temperature= 24^0C Beam radiation on horizontal surface= 650 W/m^2 Diffuse radiation (uniformly distributed in the sky)= 150 W/m^2 Tilt factors for beam, diffuse, and reflected radiation= 0.95, 0.98 and 0.05 respectively Transmissivity-absorptivity product for beam radiation falling on the collector= 0.8321 Transmissivity-absorptivity product for diffuse radiation falling on the collector= 0.79 Calculate (i) the collector heat removal factor, F_R (ii) water outlet temperature, T_{fo} (iii) instantaneous efficiency of collector, n_i Or, Evaluate the Solar Radiation Attenuation in the Cover System, mentioning the Transmissivity of the Cover System, Absorptivity of the Absorber Plate, and Transmissivity-Absorptivity Product.	**20**	**CO5**
Q 11	Use the following data to calculate the overall loss coefficient of a flat plate collector: Size of the absorber plate: 2.15 m x 1.15 m Spacing between absorber plate and 1st glass cover: 5 cm	**20**	**CO5**

	Spacing between 1^{st} and 2^{nd} glass cover: 5 cm Glass cover emissivity: 0.85 Plate emissivity: 0.9 Mean plate temperature: 75^0C Ambient air temperature: 20^0C Collector tilt: 30^0 Wind Speed: 3 m/s Back insulation thickness: 8 cm Side insulation thickness: 4 cm Thermal conductivity of insulation: 0.035 W/m-K		