Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18EE3009** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SOLAR THERMAL ENERGY CONVERSION** | **Max. Marks :** | **100** |

**ANSWER ANY FIVE QUESTIONS (5 x 16 = 80 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | What is solar radiation and radiation properties? | CO1 | 3 |
| b. | Explain the ideal coating characteristics and anti-reflective coating. | CO1 | 5 |
| c. | Draw and explain the working principle of Pyranometer. | CO1 | 8 |
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| 2. | a. | How is solar collectors classified? What are their characteristics? | CO2 | 3 |
| b. | State and derive the Fresnel law and Berga’s law. | CO1 | 4 |
| c. | Discuss the effect of the following factors on collector performance.  i) No. of covers ii) Shading iii) Selective coatings | CO2 | 9 |
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| 3. | a. | State the difference between flat plate collector and concentrating collectors. | CO2 | 3 |
| b. | Brief on the modeling of solar systems. | CO3 | 4 |
| c. | Determine the collector area required to heat 60000 liters of water upto 75°C for a dairy industry at a location with following data.  Inlet temperature of cold water = 25°C  Heat removal factor, FR = 0.9  Product (ζ.α) = 0.85  Loss coefficient UL = 4.2 W/ m2. k  Ambient temperature = 30°C  Average radiation = 22.5 MJ/ m2 day  Solar contribution = 50%  Hot water temperature = 40°C  Average daylight hours = 8 hr | CO3 | 9 |
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| 4. | a. | What is solar process loads and solar collector output? | CO4 | 3 |
| b. | Explain the energy storage in solar process systems and classification. | CO4 | 5 |
| c. | Describe the latent heat energy storage and thermo chemical energy storage. | CO4 | 8 |
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| 5. | a. | What is Solar water heating system? | CO5 | 3 |
| b. | Elucidate the Solar space heating and cooling. | CO5 | 4 |
| c. | Draw and explain the integrated collector storage systems and direct circulation systems. | CO5 | 9 |
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| 6. | a. | What is reflecting surface? | CO6 | 3 |
| b. | Elaborate the artificial neural networks in solar energy systems modeling and prediction. | CO3 | 4 |
| c. | A cylindrical parabolic collector is used in New Delhi (28.58°N,77.20°E). Compare the beam radiation which would fall on one square metre of the aperture plane of this collector from 0600 to 1800 h(LAT) on June 10 for the five tracking modes just described. The following values of Ib are available on June 10, n=161 and δ=23.012°   |  |  |  |  | | --- | --- | --- | --- | | **Time (h)** | **Ib (W/m²)** | **Time (h)** | **Ib (W/m²)** | | 0630 | 110 | 1230 | 523 | | 0730 | 240 | 1330 | 495 | | 0830 | 333 | 1430 | 445 | | 0930 | 424 | 1530 | 322 | | 1030 | 495 | 1630 | 220 | | 1130 | 550 | 1730 | 118 | | CO6 | 9 |
|  |  |  |  |  |
| 7. | a. | Explain the TRNSYS simulation program. | CO3 | 3 |
| b. | Explain the F-Chart method and program. | CO6 | 4 |
| c. | Calculate the angle made by beam radiation with the normal to a flat plate collector on December 1 at 0900h(local apparent time). The collector is located in New Delhi (28°35`,77°12`E) and is tilted at an angle of 36° with the horizontal and is pointing due south. | CO1 | 9 |
| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | |
| 8. | a. | Define Thermosyphon systems. | CO6 | 2 |
| b. | Derive the transmissibility product (**τ = τα.τρ**) for single cover solar collector. | CO2 | 6 |
| c. | Calculate the overall loss coefficient for an evacuated glass tube cylindrical parabolic focusing collector with following data.  Absorber tube : Outer diameter : 6 cm  Inner diameter : 5.5 cm  Glass cover : Outer diameter : 15.5 cm  Inner diameter : 14.8 cm  Aperture : 1.8 m  Length of Concentrator : 3.4 m  Emissivity of absorber tube surface : 0.20  Emissivity / absorptivity of glass : 0.85  Average temperature of absorber tube : 200°C  Ambient temperature : 25°C  Wind velocity : 2 m/s | CO6 | 12 |