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

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**End Semester Examination – Nov/Dec – 2017**

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| **Code :** | **17EE3052** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SOLAR THERMAL ENERGY CONVERSION** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course Outcome** | **Marks** |
| 1. | a. | Elucidate the radiative properties of non-absorbing materials with necessary equations. | CO1 | 10 |
| b. | Calculate the transmittance, reflectance and absorptance of a single glass cover 2.3 mm thick at an angle of 75⁰. The extinction coefficient of the glass is 32 m-1 and the refractive index of the glass is 1.526. | CO1 | 10 |
| (OR) | | | |  |
| 2. | a. | Find the solar altitude and azimuth angles at solar noon at New Delhi on August 16. Also find the sun rise and sunset times on that day. The latitude and longitude values of New Delhi is 28.70° N and 77.10° E. | CO1 | 10 |
| b. | Compare the different selective surface coating methods with respect to the type of material used and the constructional details. | CO1 | 10 |
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| 3. | a. | Name the components that sum up the Total Irradiance and define each one of them. | CO1 | 4 |
|  | b. | Suggest the instruments used to measure Solar radiation and explain them in detail. | CO1 | 16 |
| (OR) | | | |  |
| 4. | a. | Classify the different types of Solar collectors. | CO3 | 5 |
|  | b. | Perform the thermal analysis on Flat Plate Collector and also derive the expression for thermal efficiency. | CO3 | 15 |
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| 5. | a. | Perform the Life-cycle cost analysis on solar systems based on mortgage balance, cumulative fuel savings and cumulative savings with necessary plots. | CO4 | 8 |
|  | b. | Briefly explain the importance of discounting and inflation in solar process economics. | CO4 | 6 |
|  | c. | A fuel cost is expected to inflate at the rate of 7% per year and for the first year is Rs.25, 000 (payable at the end of the year). The market discount rate is 10% per year. What is the present worth of the payment to be made at the end of the third year? It is expected that the blower in an air heater system will need to be replaced at the end of 10 years. The cost in the first year (payable at the end of the year) would be Rs.20, 000. Under the same assumption of inflation and discount rates, what is the present worth of replacing the blower? | CO4 | 6 |
| (OR) | | | |  |
| 6. | a. | Identify the needs for storing thermal energy for future use. | CO5 | 4 |
|  | b. | With necessary diagrams, describe how thermal energy can be stored in water storage and packed bed storage system. | CO5 | 10 |
|  | c. | If you are asked to design a thermal energy storage system, what are the factors that you would look for? Explain them briefly. | CO5 | 6 |
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| 7. | a. | Elucidate the direct circulation method of Solar water heating with a neat block diagram. | CO6 | 8 |
|  | b. | Show how will you overcome the freezing condition or power failure in direct circulation method? Explain in detail. | CO6 | 8 |
|  | c. | Summarize the various conditions that a solar heating system encounters at a particular instant of time. | CO6 | 4 |
| (OR) | | | |  |
| 8. | a. | Differentiate the Adsorption and Absorption process of refrigeration. | CO6 | 5 |
|  | b. | Explain the design of every storage system. | CO6 | 10 |
|  | c. | Write short notes on Solar Pond. | CO6 | 5 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | With a neat block diagram, explain the operation of Solar Electric Generating Systems. | CO6 | 10 |
|  | b. | Discuss in detail, the solar air conditioners based on open cycle dehumidification-humidification processes. | CO6 | 10 |

ALL THE BEST