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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **18ME3025** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SOLAR ENERGY UTILIZATION** | **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. | Calculate the angle made by the beam radiation normal to a flat plate collector on December 1 at 9.00 h (local apparent time). The collector is located in New Delhi (28º35’N, 77º12’E) and is tilted at an angle of 36º with the horizontal and is pointing due south. | CO1 | 8 |
| b | Calculate the day length on May 1 and December 1 for a south facing surface tilted at an angle of 40º and located at New Delhi (28º35’N, 77º12’E). | CO1 | 8 |
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| 2. |  | Discuss briefly about the instruments used for measuring solar radiation with neat sketches. | CO1 | 16 |
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| 3. |  | Design a flat plate solar collector for the following conditions  Latitude: 21ºN  Date: 15June  Time: 10 A.M. – 11 A.M.  Annual average intensity of solar radiation: 1 langley/min  Collector tilt: 25ºN  Number of glass: 3  Heat removal factor for the collector: 0.80  Transmittance of the glass: 0.83  Absorptance of the plate: 0.87  Top loss coefficient for the collector: 1.47 kcal/hr m2ºC  Collector fluid temperature: 100ºC  Ambient temperature: 35ºC  Reflectance of the glass: 0.27 | CO2 | 16 |
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| 4. |  | Discuss the factors that affect the performance of a flat plate collector in practical situation. | CO2 | 16 |
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| 5. |  | Compare the construction and working principle of a cylindrical parabolic collector and a dish type concentrating collector. | CO3 | 16 |
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| 6. |  | Design a cylindrical parabolic concentrator, which is used for heating a thermic fluid (Cp= 2.2 kJ/kgK) enters at a temperature of 160ºC. The concentrator has an aperture of 1.8m and a length of 3 m. The absorber tube has an inner diameter of 2.8cm and outer diameter of 3.2cm and has a concentric glass cover around it.The following data is given  Reflectivity of the concentrator surface = 0.82  Intercept factor = 0.91  (τα)b=0.80  Beam radiation incident normally on aperture plane = 556 W/m2  Diffuse radiation incident on aperture plane = 152 W/m2  Overall loss coefficient = 9.5 W/m2K  Convective heat transfer coefficient on inside of absorber tube = 325 W/m2K  Ambient temperature = 27ºC  Mass flow rate of fluid = 360 kg/h | CO3 | 16 |
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| 7. |  | Explain the working principle of a matrix air heater and overlapped glass plate air heater. | CO4 | 16 |
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|  | | **COMPULSORY QUESTION (1 x 20 = 20 Marks)** |  |  |
| 8. | a. | With a neat sketch explain how a stratified storage system is used to store the thermal energy. | CO5 | 10 |
| b. | Explain the construction and working principle of a solar chimney. | CO6 | 10 |