Second Semester M. E. (Mech.) (Thermal Engg.) Examination

(Elective–III)

# SOLAR ENERGY

Paper - 2 MTE 5

P. Pages : 3

Time : Three Hours] [Max. Marks : 80

**Note :** (1) Separate answer book must be used for each section in the subject Geology, Engineering material of civil branch and separate answer-book must be used for Section A & B in Pharmacy and Cosmetic Tech.
(2) All question carry marks as indicated.
(3) Answer **Three** questions from Section A and **Three** questions from Section B.
(4) Assume suitable data wherever necessary.
(5) Illustrate your answer necessary with the help of neat sketches.

## SECTION A

1. (a) What is selective surface ? How performance of L.F. P.C. can be improved by using selective surface ? Explain with spectral distribution? 7

   (b) What kinds of solar radiation falling on earth surface ? Also explain nature of reflection from ideal, specular, diffuse and real surface with neat sketch ? 6

2. (a) Derive the equation for Transmisivity of the glass cover system of LF.P.C? 7

   (b) Explain the different type of solar thermal energy storage. What are the consideration for selection of solar energy storage and its design ? 6

3. (a) Explain the thermo chemical storage for solar energy. Which are the criteria for judging suitability of Thermochemical reaction ? 7

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(b) Expalin with neat sketch, different types of solar still used for water distillation ? 6

4. (a) Explain working principle of solar Pond. What are the operational problem of solar pond ? Explain briefly. 7

(b) Explain principle of working of solar cell. Derive Expression for maximum power output of the solar cell. 7

5. (a) A photovoltaic cell has an open circuit voltage of 0.6 volt and a short circuit current of 250 $A/m^2$ at a cell temperature of $40^0C$. Calculate the voltage and current density that maximises the power of the cell. What would be the corresponding maximum power output per unit cell Area ? 7

(b) What is the temperature requirement for industrial process heat ? Explain solar industrial process heating system using a cocentrating collector array. 6

## SECTION B

6. (a) Explain the passive solar heating with neat sketch. 7

(b) Explain solar absorption refrigeration system on lithium bromide–water absorption cycle. 6

7. (a) Find out the collector efficiency factor for the following specification. Overall neat transfer coefficient 8.00 $w/m^2k$, Spacing 150 mm, tube diameter and bond width = 10 mm, plate thicknes = 0.5 mm plate thermal conductivity = 384 w/mk, tube wall and bond material resistance are zero. The heat transfer coefficient inside the tube is 300 $w/m^2k$. 7

(b) Derive the equation for collector efficiency factor. 7

8. (a) Explain the testing procedure for liquid flat–plate collectors. 7

(b) Explain various designs of Evacuated tube collector with neat sketch. How are they superior to L.F. P.C. ? 6

9. (a) Sketch and explain different types of concentrating collectors. Discuss their application. List various advantages of concentrating collectors over flat plate collector. 7

(b) Define following terms Related to concentrating collector.

(i) Aperture.

(ii) Area concentration ratio.

(iii) Interrupt factor.

(iv) Acceptance angle. 6

10. (a) Derive the equation for heat removal factor and instantaneous collection efficiency for a cylindrical parabolic concentrating collector. 7

(b) What are the tracking challenges for concentrating collectors and what are the tracking Requirements ? How solar elevation angle. 6