

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

**MODERN ENERGY SOURCES**

Elective - I

Paper - 1 MTE 5

P. Pages : 4

Time : Three Hours ]

[ Max. Marks : 80

**Note :** (1) Answer **Three** questions from Section A and **Three** questions from Section B.  
(2) Assume suitable data wherever necessary.

1. (a) Explain different types of solar collectors with suitable sketches. Discuss the effect of following parameters on the performance of Liquid flat plate collector :—
  - (i) Intensity of solar radiation.
  - (ii) Inlet temperature of the liquid. 7
- (b) Derive expression for heat removal efficiency factor for Liquid flat plate collector. 6
2. (a) With neat sketch explain working of parabolic trough collector. Compare its performance with flat plate collector. 6
- (b) A flat plate collector with fin and tube type absorber has an overall heat transfer coefficient of  $8 \text{ W/m}^2 \text{ }^\circ\text{C}$ . The plate is 0.7 mm thick and the tube center distance is 150 mm. The fluid to tube heat transfer coefficient is  $300 \text{ W/m}^2 \text{ }^\circ\text{C}$ . Inner diameter of the tube is 20 mm. Find out collector efficiency factor for copper fin. 7
3. (a) What do you mean by solar photovoltaics ? Sketch a typical roof top solar system and list the role of each components. 6
- (b) With a suitable schematic, explain, concentrated solar thermal trough power plant with thermal storage. List a few solar thermal power plants in India and its generation capacity. 7

4. (a) 'Tidal Power is basically hydropower, explain. With suitable sketch explain single basin tidal power plant. 7
- (b) Show that the average power generation a simple, single basic tidal system is given by
- Power =  $0.225 AR^2$ , with the terms carrying usual meaning. 6
5. (a) What is OTEC ?  
Explain with suitable diagram, controlled flashed evaporator OTEC power plant. 7
- (b) If surface temperature of sea water is  $25^{\circ}\text{C}$  and deep sea temperature is  $4^{\circ}\text{C}$ , using basic principles, estimate efficiency of OTEC cycle. Despite of its low efficiency, why OTEC is a promising option for conversion of Ocean energy in to useful energy form ? 7

### SECTION B

6. (a) What is 'Betz limit' with reference to wind turbines ? Drive an expression for work output and efficiency of wind mill. Show that the maximum theoretical efficiency of wind mill is 59.3% when  $v_2/v_1 = 1/3$ . 10
- (b) Sketch different types of wind mills. Which design is more popular for power generation ? 4
7. (a) A wind turbine with 60 m rotor diameter faces wind of 40 kmph. Conversion efficiency is 0.75 and combine electrical and mechanical efficiency is 90%. Density of air is  $1.185 \text{ kg/m}^3$ . Find out :  
(i) Power output.  
(ii) Power coefficient and performance coefficient.  
(iii) Energy output per year in kwh for annual plant factor of 0.45. 7
- (b) With neat sketch explain the layout of coal fired open cycle MHD generation system. 6
8. (a) Classify various conversion systems available for geothermal energy. Take detailed review of flash steam liquid dominated power plant cycle. 8
- (b) Discuss important design parameters for geothermal power plant. 5

9. (a) What are the water cooled and moderated reactors ? Compare two designs of this type on the basis of
- (i) Level of Uranium enrichment.
  - (ii) Method of steam generation.
  - (iii) Operating pressure. 7
- (b) What are various components and their role; used in nuclear reactor. 6
10. (a) Take a brief review of various nuclear power plants in India on the basis of type, fuel used, capacity in MW etc. 6
- (b) What are fast breeder reactors ? Explain with suitable sketch, any one type of it. 7



