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M.E. First Semester (Mechanical Engineering (Thermal Engg.)) (New-CGS)

13511 : Elective - I : Modern Energy Sources : 1 MTE 5

P. Pages : 2 **AU - 3365**

Time : Three Hours * 0 3 3 2 * Max. Marks : 80

Notes : 1. All question carry equal marks.
2. Answer **three** question from Section A and **three** question from Section B.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and chemical equations should be given wherever necessary.

SECTION - A

1. a) Show that the Removal efficiency factor **7**

$$F_R = \frac{F_P M C_P}{U_L A_C F_P}\left[1 - \exp\frac{-A_C F_P U_L}{M C_P}\right]$$

b) A liquid is having absorber plate with 385 W/m°C thermal conductivity 10 mm tube diameter with spacing 160 mm, overall loss coefficient is 3 W/m² °C. Local heat transfer coefficient is 300 W/m² °C. Solder bond between the place & tube is 2 mm wide & 2mm thick solder material thermal conductivity 20 W/m°C, assuming tube wall conductivity is very high. Calculate collector efficiency factor. **6**

2. a) What are the different parameters affecting the performance of liquid flat plate collector an obtain the expression for instantaneous collection $\eta_{efficiency}$. **6**

b) Discuss the effect of following parameters on the performance of collectors : **8**
i) Selectivity of absorber surface.
ii) Fluid inlet temperature
iii) Incident solar flux
iv) Dust on top cover

3. a) Explain with neat sketch the working of a central tower concept for power generation ? Why have solar cookers not become popular? What do you suggest to make it popular ? **7**

b) Explain the I-V characteristics of a solar cell and define fill factor. What is significance of fill factor ? **6**

4. a) Show that average power generated in simple single basin power plant is $P_{av} = 0.225 AR^2$ **7**
where R - Range
A - Area of Basin

b) Sketch and explain indirect vapour cycle OTEC power plant. **6**

5. a) Describe the working principle of single basin tidal power plant. **6**

b) What are the environmental impacts of OTEC ? **7**

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SECTION - B

6.	a)	What are the principle motions significant for the operation of Wind mill.	7
	b)	A WTG is designed to produce 3.5×10^6 kwh / year power with a plant factor of 0.40. The designed wind velocity is 45 kmph conversion efficiency 0.73, mechanical efficiency is 0.90, generator efficiency is 0.96 atmospheric pressure is 100 kpa, ambient temperature is 25°C. Calculate require rotor diameter and power coefficients for rotor and generator.	7
7.	a)	Starting from the fundamentals show that the highest value of efficiency for wind mill is 59.3% which occurs at $V_2 = V_1 / 3$.	8
	b)	Explain different types of wind mill turbine blades.	5
8.	a)	Determine the power developed by an MHD $\sigma = 5$ mho / m, C = 750 m / s, $B = 5.0\,wV / m^2$ n = 0.7, V = 100m3 If the pressure at inlet and outlet are 5 atm and 0.9 atm respectively find out the length of the generator duct.	6
	b)	What are the basic factors considered for selection of geothermal plant design ? Explain the working of a flashed steam power plant.	7
9.	a)	Explain the following terms : i) Controlled and uncontrolled fission ii) Radioactivity iii) Mass number iv) Mass defect and binding energy v) Isotope	5
	b)	Draw & explain the working of boiling water reactor and discuss its advantage & disadvantages over pressurised water reactor.	8
10.	a)	Explain the working of PWR with neat sketch.	7
	b)	Explain the components of Nuclear Reactor with neat diagram.	6

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