

Seat No.: _____

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GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VIII (NEW) - EXAMINATION – SUMMER 2017****Subject Code: 2181910****Date: 29/04/2017****Subject Name: Renewable Energy Engineering****Time: 10:30 AM to 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of Solar energy data book is permissible after verification.

- Q.1 (a)** A researcher wants to calculate incidence angle for surface tilted at 30° with horizontal from the data available for horizontal surface:- **08**

Angle of incidence for horizontal surface : 45.6° Surface facing 10° East of South at locationDate : 23rd December (Non leap year)

Standard time of location: 12 p.m.

Day length for horizontal surface: 10.7 hrs.

- (b)** The following table shows the various angle of attack, lift and drag coefficient for airfoil DUV400. Find the design angle of attack. **06**

Angle of attack	2	4.1	6.2	8.1	10.2	11.3	12.1	13.2	14.2	15.3
Lift Coefficient	0.3	0.54	0.79	0.9	0.93	0.92	0.95	0.99	1.01	1.02
Drag Coefficient $\times 10^{-2}$	1.16	1.44	1.46	1.62	2.74	3.03	3.69	5.09	6.48	7.76

Calculate lift and drag force per unit length of blade for the following data.

Design wind speed = 10 m/sec

Atmospheric pressure = 1.01bar

Chord length = 15 cm.

Atmospheric temperature = 30°C

- Q.2 (a)** The following data refers to liquid flat plate collector, Collector tilt = 22.15° , Available radiation = 1100 W/m^2 , Absorber plate area = 2.1 m^2 , Plate emissivity = 0.12, Glass cover emissivity = 0.88, Number of covers = 2, Mean plate temperature = 68°C , Flux available at absorber plate = 800 W/m^2 , Side loss coefficient = $0.8 \text{ W/m}^2\text{-K}$, Bottom loss coefficient = $0.6 \text{ W/m}^2\text{-K}$, Inlet water temperature = 30°C , Ambient air temperature = 25°C , Wind speed = 1.8 m/s, Mass flow rate of water = 62 kg/hr. Determine, (1) Overall heat loss coefficient, (2) Outlet water temperature from the collector (3) Efficiency of collector. Use Test *et al.* Correlation. Take area of collector is 10% more that area of absorber plate. **07**
- (b)** Derive the one dimensional momentum theory and Beltz's limit for the wind mill. Also state the assumption in theory and draw the variation of pressure and velocity in wind mill. **07**

OR

	(b)	Explain with neat sketch the geometry of airfoil terminology. Also explain with neat sketch indicating the direction of lift force, drag force, pitching moment coefficient.	07
Q.3	(a)	Derive the expression of collector efficiency factor, heat removal factor and useful heat gain for the air heater.	08
	(b)	Explain the working of indirect solar drying system with neat sketch. Also discuss the advantages.	06
OR			
Q.3	(a)	Derive the expression of collector efficiency factor, heat removal factor and useful heat gain for the cylindrical parabolic collector.	08
	(b)	Explain the construction of solar pond with neat sketch.	06
Q.4	(a)	Discuss the following factors affecting the biogas generation (1) pH (2) Nutrient (3) Temperature (4) Diameter to Depth ratio (5) Carbon – Nitrogen ratio.	05
	(b)	Explain with neat sketch the working of hybrid OTEC system.	05
	(c)	Explain with neat sketch the vapour dominated geothermal system.	04
OR			
Q.4	(a)	Explain with neat sketch the three stage scheme for methane fermentation.	05
	(b)	Explain with neat sketch the basic and working principle of MHD generator.	05
	(c)	Explain with neat sketch the liquid dominated geothermal system.	04
Q.5	(a)	(i) For an 11,00,000/- investment in solar energy equipment which meets 56% of annual load of 156 GJ. If first year fuel cost is Rs. 800 per GJ and expected to inflate at 10% per year. Calculate (1) undiscounted payback time (2) discounted payback time if discount future cost at rate 8%. (ii) For a non-solar process, using fuel only, calculate the present worth of fuel cost over 20 years if 1 st year's cost is Rs. 125500/-. The market discount rate is 8% per year and fuel cost inflation rate is 10% per year.	04
	(b)	Write a short note on solar saving.	04
	(c)	Discuss in brief limitation of renewable energy.	02
OR			
Q.5	(a)	What is the annual payment and present worth of all interest payment on mortgage, if solar system is installed having worth Rs.11,00,000/- which is to be financed by a 10% down payment with the balance borrowed at an annual interest rate of 9% for 20 years? The payments are to be made at the end of the year. The market discount rate is 8%.	09
	(b)	Define (1) Payback time (2) Return on investment (3) Life cycle cost	03
	(c)	Discuss in brief advantages of renewable energy.	02
