

Date: 07/05/2016

GANPAT UNIVERSITY

B. Tech. Semester: VIII (Mechanical Engineering)

CBCS Regular Examination April-June 2016

Subject: 2ME 801 ALTERNATIVE ENERGY SOURCES

Time: 3 Hours

Total Marks: 70

Instruction: 1. Attempt all questions.

2. Don't write anything on the question paper.

3. Use of non-programmable scientific calculator is permitted.

4. Draw neat sketches and assume suitable additional data, if necessary.

5. Figures to the right indicate full marks of the question.

SECTION I

- Que. - 1 (a) Calculate Local Apparent time (LAT) and Declination at Mehsana (location longitude $77^{\circ}30'$; E, latitude $24^{\circ}20'N$) corresponding to 12.30 IST on July 24. Equation of time correction (ETC = $5^{\circ}13''$) 6
- (b) What are the types of Ocean Thermal Energy Conversion (OTEC) systems? Explain any one of them briefly. 6

OR

- Que. - 1 (a) Explain with a neat sketch the construction and working Janta model biogas plant. State also its advantage and disadvantages. 6
- (b) Explain briefly the factors which affect the performance of a flat-plate collector. 6
- Que. - 2 (a) Write short notes on various solar thermal energy storage systems. 5
- (b) Plot the variation of τ_r , τ_a and τ with the angle of incidence for the following cover system: 6

Material	Glass
Number of cover	4
Thickness of each cover	4 mm
Refractive index of glass relative to air	1.55
Extinction coefficient of glass	16 m^{-1}

OR

- Que. - 2 (a) Explain briefly any two of the following: 4
- (i) Horizontal axis wind machines.
- (ii) Savonius types wind mill
- (iii) Darrieus type wind mill
- (iv) Propeller type wind mill
- (b) Explain briefly "Evacuated collectors" 4
- (c) Write a short note on "the environmental impacts of Geothermal energy in India and abroad" 3

Que. - 3 (a) Calculate the energy content of the wind per square meter for following situation:

Location:	Indore
Month:	June
Height above ground:	10.9 m
Take $\rho = 1.20 \text{ kg/m}^3$	

- (b) Explain briefly the following:
 (i) Thermal -chemical storage, and (ii) Electrical storage.

SECTION-II

Que. - 4 (a) A compound parabolic collector (CPC) 1.5 m long has an acceptance angle of 20° . The surface of the absorber is flat with a width of 15 cm. Evaluate the concentration ratio, the aperture height and the surface area of the concentrator.

- (b) Explain briefly, with neat sketches, any two of the following concentrating collectors:
 (i) Paraboloidal dish collectors (ii) Fresnel lens collectors
 (iii) Flat-plate collector with adjustable mirrors (iv) Parabolic trough collector

OR

- Que. - 4 (a) What is the MHD generation? How does it work?
 (b) Write short notes on (i) PV hybrid system and (ii) Grid-interactive solar PV system.

- Que. - 5 (a) Determine the sunset hour angle and day-length at a location latitude of 32° on March 30.
 (b) Write a short note on the global scenario of tidal energy.

OR

Que. - 5 (a) What is "photovoltaic effect"? Explain briefly.

(b) The following data relate to a propeller turbine:

Velocity of wind at 18°C	21m/s (At atmospheric Pressure)
Turbine Diameter	10 m and,
Operating Speed of Turbine	40 r.p.m. at maximum efficiency.

Calculate:

- (i) Total Power Density in the wind stream.
 (ii) Maximum obtainable power density.
 (iii) Reasonably obtain power density.
 (iv) Total Power generated.

Que. - 6 (a) Calculate the solar swing angle on May 1 from 0800 hrs to 1200 hrs in Pune (18.53°N)

(b) Define the following angles:

- (i) Latitude angle (ii) Hour angle (iii) Zenith angle (iv) Surface azimuth angle

2to2

END OF PAPER

Wind Data

Percentage frequency distribution of hourly wind speed

Location: Indore Airport

Interval (kmph)	J	F	M	A	M	J	J	A	S	O	N	D	Annual
00	10	16.4	9.9	9.3	3.2	2.3	2.3	3.3	7.1	14.9	6.9	8	7.7
00-02	3.8	1.7	1.9	1.4	1.6	1.1	0.6	0.3	2.4	3	5.9	1.9	2.1
02-04	5.3	1.9	3	0.9	0.9	0.6	0.5	0.4	3.1	3.4	4.1	2.2	2.1
04-06	5.1	4.1	2.7	1.5	1.3	0.7	1.1	0.4	3.3	4.2	4.5	4.4	2.7
06-08	4.3	3.6	2.1	2.2	2	1.4	1.2	0.8	3.1	3.9	4.7	5.8	2.9
08-10	2.6	0.5	1.1	0.6	1.3	0.4	0.9	0.4	0.6	1.2	1.7	1.2	1
10-12	6.8	5.4	3.8	4.4	3.9	2.9	3.4	1.7	5.2	5.2	6.2	8.9	4.8
12-14	6.9	6.4	5.4	3.2	4	3.9	3.5	2.2	4.5	5.9	7.9	8.5	5.1
14-16	9.2	8.9	9	5.1	6.3	7	7.7	4.2	6.5	8.2	10.4	10.8	7.7
16-18	9.2	10	8.8	5.2	6.2	7.1	8.3	5.4	7.5	9.6	13.6	9.9	8.3
18-20	8.7	9.2	9	5.3	6.5	6.2	9.2	6	7.2	8.3	12.9	9.1	8.1
20-22	10.8	11.4	10.1	10.2	10.3	10.4	11.3	10.5	10.1	9.7	9.7	10.5	10.4
22-24	6	5.7	7.7	6.8	7.4	7.7	9.5	7.4	7.3	7.3	4.5	7.5	7.2
24-26	4.9	4.9	8.2	8.2	8	9.6	10.8	10.1	9.5	6.8	2.9	5.6	7.6
26-28	1.6	3.4	3.2	7.1	4.3	6.4	3.6	4.6	4.4	3.1	1.5	3.2	4
28-30	1.9	1.9	4.9	5.8	5.1	5.2	7.4	7.9	4.3	2.4	1.1	1.5	4.3
30-32	1.6	3	3.8	8.5	7.5	8.6	7	10.5	7	1.8	0.7	0.7	5.2
32-34	0.5	0.6	2	4.5	4.5	3.8	3.7	6.1	2.5	0.7	0.4	0.2	2.6
34-36	0.4	0.6	1.5	4	5.7	3.8	3	5.6	2.5	0.4	0.3		2.4
36-38	0.4	0.3	1.2	2.5	4.1	3.7	2.6	5.1	1.2		0.1		1.9
38-40		0.1	0.5	1.1	1.7	2	1.1	2.4	0.6				0.8
40-42			0.2	1.4	2.2	3.1	0.7	2.2	0.1				0.5
42-44				0.3	0.8	0.6	0.2	0.8					
44-46				0.2	0.7	0.4		0.7					
46-48					0.1			0.3					

Sensor 10.9 m above ground