

GUJARAT TECHNOLOGICAL UNIVERSITY**ME - SEMESTER-IV • EXAMINATION – WINTER • 2014****Subject Code: 742101****Date: 26-11-2014****Subject Name: Non-Conventional Energy Conversion Systems****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Establish the preliminary solar array area and battery size for the average load of 67 W for 24 hours. Solar cell efficiency is 10% and sum total of all array design and degrade factor is 0.5. Battery efficiency is 60%. The load is to be supported for 7 continuous days of cloudy weather and battery is to be fully recharged in 3 days. Average monthly isolation is 181k Wh/m². **07**
- (b)** The following data refers to a propeller type horizontal axis wind turbine: **07**
Rotor diameter =120 m, speed of wind=10 m/s, air density=1.229 Kg/m,
Rotor speed=40 rpm, coefficient of performance=40%, calculate
1. Total power density in wind system.
 2. Total power available in wind K W.
 3. Maximum extractable power.
 4. Maximum torque and axial thrust.
- Q.2 (a)** Calculate the average energy of the electrons from an emitter at temperature 1000 K, 2700 K Boltzmann constant=6.82 x 10⁻⁵ Ev/K **07**
- (b)** Explain principle, operation and design consideration of fuel cells. **07**
- OR**
- (b)** Define the following: solar constant, spectral distribution of extraterrestrial radiation, Attenuation of beam radiation, equinox and solstice, solar angle, solar time. **07**
- Q.3 (a)** Describe the factors that affect the size of bio gas plant. Also describe the materials used for the bio gas generation. **07**
- (b)** Explain design considerations of K.V.I.C. digester. **07**
- OR**
- Q.3 (a)** How are bio gas plants classified? Explain them briefly giving their advantages and disadvantages. **07**
- (b)** Explain design considerations of flat plate collectors. **07**
- Q.4 (a)** Describe schematic diagram and working of MHD power generating system. **07**
- (b)** Describe the basic principal of wind energy conversion and derive the expression for power developed due to wind. **07**
- OR**
- Q.4 (a)** With usual notations derive an expression for collector efficiency of a cylindrical parabolic concentrating collector. **07**
- (b)** Write short note on: Environmental aspects and economic consideration of wind machines. **07**
- Q.5 (a)** Draw neat and labeled sketches of following: **07**
1. Up draft gasifier
 2. Down draft gasifier
 3. Fluidized bed gasifier
 4. Cross draft gasifier

- (b) Mention problems associated with development of hydrogen energy, its advantages and limitations. **07**

OR

- Q.5** (a) Write short note on: Performance analysis of thermoelectric materials and their selection. **07**
- (b) Justify the statement "the future fuel of the world will be hydrogen obtained by electrolysis of water with energy". **07**