



Name :
Roll No. :
Invigilator's Signature :

CS/B.Tech (ICE)/SEM-8/EE-802G/2013

2013

NON CONVENTIONAL ENERGY SOURCES

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
 $10 \times 1 = 10$
- i) The energy payback period of a single crystal silicon cell is
- a) 6 months to 1 year b) 1 to 2 years
c) 10 to 20 years d) 3 to 5 years.
- ii) Extra terrestrial insolation is
- a) 1000 w/m^2 b) 1353 w/m^2
c) 100 w/m^2 d) 1453 w/m^2 .
- iii) The efficiency of a commercial solar cell lies in the range
- a) 0-10 % b) 10-20 %
c) 20-30 % d) 50-60 %.

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viii) The number of blades of multi-blade wind turbine usually ranges from

- a) 13 to 30 b) 12 to 20
- c) 14 to 28 d) 16 to 30.

ix) Which one is correct with conventional symbols ?

- a) $P = \frac{1}{2} \rho A^2 V^3$ b) $P = \frac{1}{2} \rho A V^2$
- c) $P = \frac{1}{2} \rho A V^3$ d) $P = \frac{1}{2} \rho A^2 V^2$

x) For a horizontal axis windmill the tip speed ratio is

- a) a cubic function of number of blades
- b) proportional to the number of blades
- c) inversely proportional to the number of blades
- d) a square function of number of blades.

xi) The optimum solid concentration in a biogas is

- a) 37-39 % b) 27-29 %
- c) 17-19 % d) 7-9 %

xii) Biodiesel is obtained from

- a) fermented sugar
- b) pyrolysis process
- c) exudates of plants
- d) an upgraded vegetable oil.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. a) Derive an expression for dark current, open circuit voltage and maximum power.

b) What do you mean by fill factor ? 3 + 2
3. a) What is the difference between lift and drag force ?

b) Describe the orientation systems of the vertical axis machines. 1 + 4
4. Find the open circuit voltage of the single crystal silicon solar cell having the short circuit current rating of $I_s = 3$ amps and dark current $(I_0) = 5 \times 10^{-9}$ amps at 28°C. Find the peak power with a fill factor of 0.8.
5. Differences between thermo chemical and biochemical biomass conversion technologies ?
6. Describe in brief different types of gasifier system.



GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe the fabrication process of silicon single crystal solar cell starting from SiO_2 .
- b) Draw a sketch and label the following parts – encapsulation, anti-reflecting coating current collecting figures-n junction with depletion layer & the bottom electrode.
- c) Explain why series-parallel connection of solar cells are made and why diodes are put in the series link in a given direction ? $5 + 5 + 5$
8. a) What are the major steps involved in the biomethanation of organic residues. 5
- b) With probable chemical equations describe gasification of solid biomass in a up-draft gasifier. 7
- c) What are the different process parameters which affect the rate of biogas production inside a biogas digester. 3



9. What factors are taken into consideration in site selection for wind power generation ?

A HAWT has the following data : Speed of the free wind at height of 10m is 12m/s.

Air density = 1.23 kg/m^3

$A = 0.13$

Height of the tower is 100 m

Diameter of the rotor is 80 m

Wind velocity at the turbine reduces by 20 %

Generator efficiency is 85%

Find

Total available power in wind

Power extracted by the turbine

Electrical power generated. 5 + 10

10. What are the different types of Solar cell ? Derive expression for maximum power output and efficiency of a Solar cell. The band gap for GaAs is 1.36eV. Calculate the optimum wavelength of light for photovoltaic generation in a GaAs Cell.

4 + 4 + 7



11. Write short notes on any three of the following : 3×5

- a) Wave energy
- b) Biodiesel
- c) Double basin tidal energy
- d) Vapour dominated geothermal system
- e) Floating dome type biogas plants.

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