

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 x 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 %. |

iv) A two-blade wind turbine produces maximum power

when the tip-speed ratio is equal to

- a) π
- b) 2π
- c) 3π
- d) 0.593.

v) Ocean wave energy can be effectively stored as

- a) Hydrogen energy
- b) Electrical energy
- c) Thermal energy
- d) Mechanical energy.

vi) Electrical machines used for wind turbine power

generation are

- a) synchronous machine only
- b) induction generators only
- c) DC generators only
- d) anyone of the above.

vii) Peak power rating of a typical solar cell 10 cm diameter is

- a) 1 watt
- b) 5 watt
- c) 10 watt
- d) 100 watt.

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) $P = 1/2 \rho A^2 V^3$ b) $P = 1/2 \rho A V^2$

c) $P = 1/2 \rho A V^3$ d) $P = 1/2 \rho A^2 V^2$

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.

(Short Answer Type Questions)

Answer any three of the following. $3 \times 5 = 15$

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) = 5×10^{-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/m³

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 Ga As is 1.36eV. Calculate the optimum wavelength of light for photovoltaic generation in a Ga As Cell.

4 + 4 + 7

11. Write short notes on any three of the following : 3x5

a) Wave energy

b) Biodiesel

c) Double basin tidal energy

d) Vapour dominated geothermal system

e) Floating dome type biogas plants.