Name : .....

Roll No. : .....

Invigilator's Signature : .....

2011
RENEWABLE ENERGY TECHNOLOGY

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) Which is not an energy efficient crop on the basis of their fuel content ?

a) Sunflower b) Sugarcane

c) Ssoybean d) Spinach.

ii) Specific fuel consumption (SFC) is defined as

a) kg of fuel consumed per kg of food cooked

b) gm of fuel consumed per kg of food cooked

c) gm of fuel consumed per gm of food cooked

d) kg of fuel consumed per gm of food cooked.

iii) Photosynthetically active radiation (PAR) constitutes solar radiation of

a) 90 to 95 % b) 80 to 85 %

c) 60 to 65 % d) 40 to 45 %.

iv) Compared with coal biofuels have

a) higher hydrogen to carbon ratio

b) lower hydrogen to carbon ratio

c) equal hydrogen to carbon ratio

d) equal oxygen to carbon ratio.

v) Which of the following semiconductor materials are mainly used in solar cells ?

a) Ga b) As

c) Cd d) Si.

vi) The microbe used for excellent ethanol production is

a) *Z. mobilis*

b) *Aspergillus niger*

c) *Bacillus subtilis*

d) *Clostridium thermocellum.*

vii) HOG fuel is

a) ethanol

b) mixture of ethanol and methanol

c) mixture of wood and bark waste

d) fossil fuel.

viii) Biogas mainly consists of

a) CO_2 and CH_4 b) CO_2 and H_2

c) H_2S and N_2 d) CH_4 and H_2S.

ix) Microorganism mainly used for recovery of oil is

a) *Pseudomonas putida*

b) *Zoogloea ramigera*

c) *Alkaligens eutrophus*

d) *Bacillus subtilis*.

x) A reactor which uses U^{235} only as the fuel and releases energy is called

a) electromagnetic reactor

b) burrier reactor

c) moderator

d) fusion reactor.

xi) Which one of the following microorganisms is a metal-reducing bacterial applied in microbial fuel cell (MFC) ?

a) *Shewanella putrefaciens*

b) *Geobacter sulfurreducens*

c) *Pyrococcus furiosus*

d) *Thermus aquaticus*.

xii) Which one of the following is not a process for physicochemical pretreatment of ligno-cellulose for bioethanol production ?

a) Acid catalysed steam explosion

b) Acid-freeze explosion

c) Alkaline wet oxidation

d) Hydrogenation.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

2. a) Draw a simple sketch of a typical solar power heater.

b) Explain how could you set up an electric power plant associated with Solar Pond ? 3 + 2

3) a) How is ethanol obtained form biomass ?

b) What are the major steps of anaerobic methanogenesis ? 2 + 3

4) a) What is biophotolysis ?

b) Write in brief how hydrogen is produced by photosynthetic microorganism. 2 + 3

5. a) What are the components of lignocellulosic materials ?

   b) Write one organism which can enzymatically hydrolyze cellulose into glucose.

   c) Write down the principal enzymes responsible for enzymatic hydrolysis of lignocellulose biomass. 1 + 1 + 3

6. a) What do you mean by nuclear meltdown ?

   b) What is the function of collision rod in nuclear reactor ?

   c) Mention any one risk factor associated with nuclear reactor. 3 + 1 + 1

7. If the energy output of the sun is constant, why do we receive more radiation in summer than in winter ? 5

GROUP – C

(Long Answer Type Questions)

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

8. a) What happens when light falls on the p-n junction at the heart of a solar cell ? Explain.

   b) Define air mass ratio for the spectral power distribution using solar energy.

   c) What are the basic general rules to be followed for optimizing the use of passive solar heating of buildings ? 5 + 5 + 5

9. a) Describe the role of C/N ratio for the efficient generation of biogas in anaerobic digestion process.

   b) Discuss the effect of particle size of substrate and volatile matter concentration on the rate of digestion of waste material. 7 + 8

10. a) What is the principle working behind Geothermal energy.

    b) Briefly explain different types of Geothermal Electric power plant on the basis of geothermal fluid and type of turbine.

    c) What are the major limitations of Geothermal energy ?

    d) Draw a simple flow diagram of petrothermal geothermal power plant. 3 + 6 + 3 + 3

11. a) What are Biosurfactants ? What are their major applications ?

    b) What is Xanthan gum ? Briefly explain the chemistry, production and applications.

    c) What is Ocean Thermal Energy Conversion (OTEC) system ? 1 + 5 + 1 + 6 + 2

12. Mention one xanthan producing strain. For an industrial production of xanthan explain –

    a) the nutrient used

    b) fermentation parameters like pH, temperature, fermentation time, oxygen supply.

    c) How xanthan is purified from fermentation broth. What are the major application of xanthan ?

    1 + 2 + 3 + 4 + 5

13. How is ethanol produced by fermentation ? Write a summary on how vegetable oils can be used for production of bio-diesel. 7 + 8