Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech (TT/APM)/SEM-8/TT-801/2011
2011
ENERGY SCIENCE

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 × 1 = 10

    i)   Human Development Index (HDI) of a country measures human development in terms of three criteria. They are

         a)   number of population, nuclear capability, education level

         b)   education level, GDP and life expectancy

         c)   life expectancy, per capita energy consumption and number of population.

ii) "Cetane number" of a fuel refers to

    a)   gasoline

    b)   diesel

    c)   biogas

    d)   synfuel

    e)   none of these.

iii) Unit of energy 'quad' equals

    a) 10^{18} Joules

    b) 10^{14} B Th.

    c) 10^{30} Calorie.

iv) The most widely used material of a solar cell is

    a)   Arsenic   b)   Cadmium

    c)   Silicon   d)   Steel.

v) Point out the country having maximum number of nuclear power plants

    a)   United States of America

    b)   Russia

    c)   Germany

    d)   France

    e)   Britain.

vi) 'Load factor' of a power station is defined as

    a)   maximum demand/average load

    b)   average load × maximum demand

    c)   average load/maximum demand

    d)   none of these.
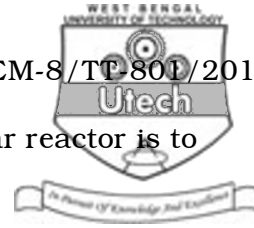
vii) Function of the moderator in a nuclear reactor is to

  a) stop chain reaction

  b) absorb neutrons

  c) reduce speed of neutrons

  d) reduce temperature.

viii) Petrol commercially available in India for Indian passenger cars has octane number in the range

  a) 40 to 50   b) 60 to 70

  c) 80 to 85   d) 95 to 100.

ix) Overall efficiency of thermal power plant is equal to

  a) Rankine cycle efficiency

  b) Carnot cycle efficiency

  c) regenerative cycle efficiency

  d) boiler efficiency × turbine efficiency × generator efficiency.

x) A consumer has to pay lesser fixed charges in

  a) flat rate tariff

  b) two part tariff

  c) maximum demand tariff.

xi) Carbon credit measures

  a) amount of excess carbon emission to be compensated with

  b) amount of carbon emission a country responsible for

  c) none of these

xii) Induction motor normally runs with

  a) leading power factor load

  b) lagging power factor load

  c) unit power factor load.

GROUP – B

(Short Answer Type Questions)

Write short notes on *three* of the following.   3 × 5 = 15

2. What do you mean by energy audit ? Explain briefly the differences between primary and detailed energy audits. 1 + 4

3. What do you think are the problems associated with leaded petrol ? In what respect does it add to the value of the fuel in which it is mixed ? How can you offset the negative attribute of leaded petrol ?   2 + 2 + 1

4. "In an era of energy crisis, nuclear energy option may not be a viable means to resort to". Justify your opinion from all angles of consideration.

5. Name different kinds of motors as used in the industry. On what does the efficiency of motors depends ? What measure do you suggest to improve it ?   1 + 2 + 2

6. What is bio-mass ? Enumerate its composition in a standard sample. Briefly explain the thermochemical conversion of biomass into energy.   1 + 1 + 3

7. What is the relationship between production realization techniques and energy saving ?   5

GROUP – C

(**Long Answer Type Questions**)

Answer any *three* of the following.   3 × 15 = 45

8. Discuss briefly the principles of harnessing tidal wave, ocean thermal and geothermal energy and their prospect as a vital source of energy in the global context today.

   What are the limitations of the energy that can be obtained from the oceans ?

   What steps would you suggest to reduce energy consumption or use it in an efficient and judicious way at home and in the industry ?   8 + 4 + 3

9. Explain the theory of nuclear fission and nuclear fusion as applied to the concepts of harnessing energy for peaceful purposes.

   What kind of reactors are prevalent in the nuclear energy sector ? In what respect do you think nuclear fusion in a better option than nuclear fission ?

   What are the functions of moderators in nuclear power plant ? What are the obstacles in making nuclear energy a foremost supplier of our need in a country like India ?

$$6 + 1\tfrac{1}{2} + 3 + 1\tfrac{1}{2} + 3$$

10. a) The daily load curve for a power plant is given by the following equation :

   $L = 350 + 10t - t^2$ where t is time in hours from 0 to 24 hours and L is in MW; calculate :

   i)   value of maximum load and when it occurs

   ii) load factor of the plant.

   b) A diary farm has average power factor of 0·75 with an average load 650 kW. What will be the size of capacitor bank, if power factor is to be improved to 0·9 ?   8 + 7

11. Make a broad-based classification of petroleum. Explain in detail the different steps of refinement of petroleum from its crude.

   Among the various fractions, discuss gasoline, diesel and kerosene in regard to composition, use and fractionation temperature.

   Why do prices of oil rise so frequently in the world market ?

   2 + 6 + 4 + 3
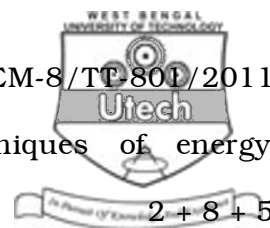
12. Discuss at least four practical techniques of energy conservation in the textile industry. 2 + 8 + 5

13. a) What is power factor in an A.C. circuit ?

   b) What are the methods by which power factor can be improved ? Explain any one of them.

   c) A synchronous motor improves the power factor of load of 200 kW from 0·8 lagging to 0·9 lagging. Simultaneously the motor carries a load 80 kW. Find

   i) the loading KVAR supplied by the motor

   ii) the motor p.f.

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

   a) Grindability and swelling index of coal

   b) Cetane and octane rating of fuel

   c) Fast breeder reactors

   d) L.P.G. (Liquefied petroleum gas)

   e) Fuel cells.