Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(EE-OLD)/SEM-7/EE-703B/2009-10

2009

POWER GENERATION ECONOMICS

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 power generated by two plants are P_1 = 50 MW, P_2 = 40 MW.

If the loss co-efficients are B11 = 0·001, B22 = 0·0025 and B12 = – 0·0005, then the power loss will be

a) 5·5 MW

b) 6·5 MW

c) 4·5 MW

d) 8·5 MW.

ii) A system has 5 generators each having a capacity of 400 MW. If 4 of these generators are running while the system load is 1300 MW. The spinning reserve is

a) 700 MW b) 300 MW

c) 1600 MW d) 1300 MW.

iii) Frequency variation occurs in power systems due to

a) unbalance between active power generation and load

b) unbalance between reactive power generation and load

c) unbalance between MVA demand and MVA generation

d) unbalance between the loadings at different phases.

iv) If the load factor increases, the cost of generation per kWh

a) increases

b) decreases

c) remains unaffected

d) may increase or decrease.

v) Electrostatic precipitator is installed in a steam power plant between

a) induced fan and chimney

b) air preheater and induced fan

c) economiser and air preheater

d) boiler furnace and economiser.

vi) Penalty factor in economic operations of the power system is to be considered when

a) generator losses are considered

b) turbine losses are considered

c) transmission losses are considered

d) none of these.

vii) Low diversity factor

a) increases system installation cost

b) reduces system installation cost

c) does not affect system installation cost

d) may increase or decrease the installation cost.

viii) Annual depreciation cost of a plant may be calculated by

a) straight line method

b) sinking fund method

c) diminishing value method

d) all of these.

ix) One kilogram of natural uranium gives an energy equivalent to

a) 100 kg of coal b) 1000 kg of coal

c) 500 kg of coal d) 10000 kg of coal.

ix) Steam power plant runs with

a) Rankine cycle b) Brayton cycle

c) Otto cycle d) none of these.

xi) If the penalty factor of a plant is unity, its incremental transmission loss is

a) 1·0 b) 0

c) – 1·0 d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Explain briefly : $2 \times 2\frac{1}{2}$

   a) Capital cost

   b) Operational cost

3. List the factors to be considered in designing a power plant. 5

4. Define "incremental fuel cost". The incremental generating cost of two generating units are given by

   $C_1 = 0{\cdot}1\,X + 20$ Rs. / MW. hr

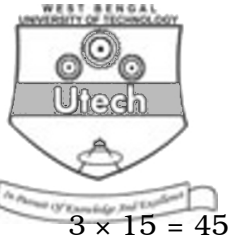
   $C_2 = 0{\cdot}15\,Y + 20$ Rs. / MW. hr

   where X & Y are power (in MW) generated by two units. For a tolal demand of 300 MW, determine the economic operating schedule of generation of both the generators & the corresponding cost of generations. 5

5. a) What do you understand by economics of power generation ?

   b) Explain the terms 'interest' and 'depreciation' as applied to economics of power generation. 2 + 3

6. Discuss the economic justification of pumped storage plants. 5



GROUP – C

(Long Answer Type Questions)

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

7. Give the comparison of Thermal Power Plant, Hydro-electric Power Plant and Nuclear Power Plant on the basis of initial cost, operating cost, maintenance cost *T* and *D* cost, efficiency and availability of source of power. 15

8. a) What do you understand by load curve ?

   b) What information is conveyed by a load curve ?

   c) A proposed station has the following daily load cycle :

Time (Hrs)	6 – 8	8 – 11	11 – 16	16 – 19	19 – 22	22 – 24	24 – 6
Load (MW)	20	40	50	35	70	40	20

   Draw the load curve select suitable generator units from the 10,000 ; 20,000 ; 25,000 and 30,000 kVa. Prepare the operation schedule for the machines selected and determine the load factor from the curve.

   3 + 4 + 8

9. a) What are the objectives of consumer tariff fixed by the power supply undertakings ? What is the difference between two-part tariff and three-part tariff ? 2 + 5

   b) A factory has a maximum load of 240 kW at 0·8 p.f. lagging, with an annual consumption of 50,000 units. The tariff is Rs. 50 per kVa maximum demand plus 10 paise per unit. Calculate the flat rate of energy consumption. What will be the annual saving if power factor is raised to unity ? 8

10. a) Derive an expression relating incremental cost of generation of a plant to the incremental transmission loss associated with the plant. What is meant by penalty factor ? 6 + 3

b) Find the saving in rupees per hour for economic allocation of load between two generating units having incremental cost of generation :

$$\frac{dC_1}{dP_{G_1}} = 25 + 0{\cdot}2\,P_{G_1} \text{ and } \frac{dC_2}{dP_{G_2}} = 32 + 0{\cdot}2\,P_{G_2}$$

as compared with their sharing the output equally, when the total output is 150 MW. 6

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

a) Economic load dispatch

b) Reactive power optimisation

c) Load curve and load distribution curve

d) Pool tariff in transmission system

e) Optimal hydro-thermal scheduling.