



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech(EE-NEW)/SEM-7/EE-704C/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.

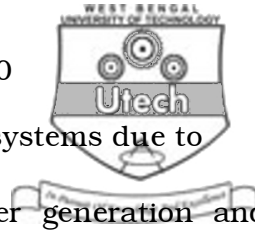
GROUP – A

(Multiple Choice Type Questions)

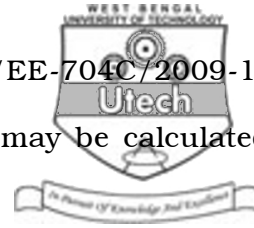
1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) 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.
- ii) The power generated by two plants are $P_1 = 50$ MW, $P_2 = 40$ MW. If the loss co-efficients are $B_{11} = 0.001$, $B_{22} = 0.0025$ and $B_{12} = -0.0005$, then the power loss will be
- a) 5.5 MW b) 6.5 MW
- c) 4.5 MW d) 8.5 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 loading 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) 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.



- vi) 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.
- vii) 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.
- viii) 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.
- ix) 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.

- GROUP – B**

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

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5. Define the terms “load factor” & “diversity factor” and explain the economic implications of these factors on the energy generations.
6. Discuss briefly about unit commitment and spinning reserve.

GROUP – C

(Long Answer Type Questions)

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

7. a) Show that transmissin loss of a power system can be expressed as a function of the active power outputs of the generators in the system. State the assumptions you make. $5 + 2$
- b) The loss coefficients for a system with two plants are

$$B_{11} = 0.001 \quad B_{12} = 0.0007 \quad B_{22} = 0.0015$$

If the power outputs are 200 MW and 150 MW respectively, determine the load on the system. Also, calculate the penalty factors of the plants.

If the system λ is Rs. 130 per MWh, calculate the incremental fuel costs of the plants. $4 + 2 + 2$



8. a) Explain the difference between the Unit Commitment and the Economic Dispatch problem. 3
- b) What are the various costs to be considered in the Unit Commitment problem ? 3
- c) Why are minimum ON time and minimum OFF time constraints important ? 3
- d) Discuss the basic principle of the dynamic programming method in solving the Unit Commitment Problem. 6
9. a) Define the terms 'load factor' and 'diversity factor'. Explain the effect of these factors on the cost of energy generation.
- b) A power station has to meet the following load demand :
- Load X : 50 kW between 10 AM and 6 PM
- Load Y : 30 kW between 6 PM and 10 PM
- Load Z : 20 kW between 4 PM and 10 PM
- Plot the daily load curve and determine :
- i) diversity factor
- ii) load factor.



10. a) What is a tariff ? Discuss and compare various tariffs commonly practised by utilities.
- b) A small scale industry has a maximum demand of 50 kW and maintains a monthly load factor of 60%. A power utility offers the following alternative tariff :
- i) Standing charge of Rs.. 30 per kW of maximum demand plus Rs. 1.20 per kWhr.
 - ii) First 500 units at Rs. 2.00 per unit, next 500 units at 1.50 per unit and additional energy at Rs. 1.10 per unit.

Which of the two tariffs is economical and what is the corresponding monthly bill ?

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

- a) Cross-subsidization
- b) Base load and Peak load stations
- c) Difference between Load curve and Load duration curve
- d) Availability based tariff.
- e) Reactive power optimisation.

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