

CS / B.Tech (EE) (Supple) / SEM-7 / EE-703B / 09
POWER GENERATION ECONOMICS (SEMESTER - 7)



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the
Candidate

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CS / B.Tech (EE) (Supple) / SEM-7 / EE-703B / 09
ENGINEERING & MANAGEMENT EXAMINATIONS, JULY - 2009
POWER GENERATION ECONOMICS (SEMESTER - 7)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
b) For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

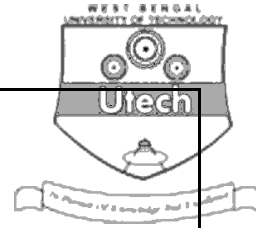
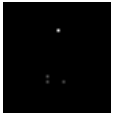
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Marks Obtained

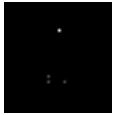
Group – A								Group – B				Group – C				Total Marks	Examiner's Signature
Question Number																	
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Head-Examiner / Co-Ordinator / Scrutineer

S-53025 (28/07)



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POWER GENERATION ECONOMICS
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GROUP – A**(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) The cost function of a generating station being a quadratic equation, the incremental fuel cost expression will be

- a) linear b) non-linear
c) parabolic d) sinusoidal.

ii) Unscheduled interchange (UI) changes of power are taken care of in tariff

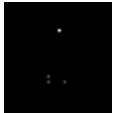
- a) ABT b) TOD tariff
c) normal bulk supply tariff d) fuel cost of the plant.

iii) The unit of incremental operating cost of generation is

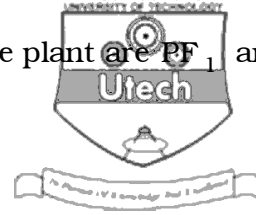
- a) rupees (Rs.) b) Rs. /kW
c) Rs. /kWhr d) Rs. /kVA.

iv) Pumped stage plants are economical in

- a) predominantly hydro system b) predominantly thermal system
c) both (a) and (b) d) never economical.



- v) Two plants A and B of identical cost curves are situated at 100 km and 50 km away from the load centre. If penalty factors of the plant are PF_1 and PF_2 , then



a) $PF_1 > PF_2$

b) $PF_1 < PF_2$

c) $PF_1 = PF_2$

d) can not be determined from given data.

☐

- vi) Input-output (I-O) curve of a plant is known. The incremental fuel cost can be determined by

a) differentiating the I-O curve

b) integrating the I-O curve

c) averaging the I-O curve at the minimum and maximum output condition

d) none of these.

☐

- vii) Unit commitment schedule of the thermal plants are to be determined well in advance because

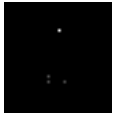
a) thermal plants need long time to start up and shut down

b) thermal plant can not operate as peaking plant

c) spinning reserve has to be maintained

d) all of these.

☐



viii) Unit commitment problem is solved on the basis of

- a) load actually occurring on the system
- b) forecasted load
- c) peak load only
- d) last day load.



ix) Load factor of a consumer is 35% and monthly consumption is 504 kWh. Maximum demand is

- a) 1.75 kW
- b) 176.4 kW
- c) 5.88 kW
- d) can not be determined.

x) Diversity of demand

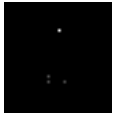
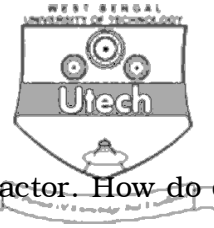
- a) increases installation cost
- b) decreases installation cost
- c) decreases operation cost
- d) both (b) and (c).

xi) A thermal power plant is suitable for supplying

- a) fixed load
- b) variable load
- c) peak load
- d) all of these.

xii) Smooth supply of reactive power output can be obtained from

- a) shunt capacitor
- b) synchronous condenser
- c) static var compensator
- d) both (b) and (c).

**GROUP – B****(Short Answer Type Questions)**Answer any *three* of the following.

3 ∞ 5 = 15

2. Explain the term operating load factor & connected load factor. How do diversity factor influence the cost of generation ?
3. Discuss the main features of the availability based tariff.
4. a) Differentiate between the single part & two part tariffs as applicable for bulk power transactions.
b) Differentiate between the plant capacity factor & plant use factor.
5. Show that transmission loss can be expressed as a function of the active power output of the generation.
6. Two generators rated 200 MW and 400 MW are operating in parallel. The droop characteristics of their governors are 4% and 5%. Assuming that the generators are drooping at 50 Hz at no load, how would a load of 600 MW be shared between them ? What will be the system frequency at this load ? Assume free governor operation.

GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following.

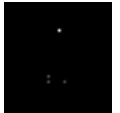
3 ∞ 15 = 45

7. a) Explain with reasons why power factor tariff is imposed on the consumer. Derive an expression for the most economic power factor of a plant. 3 + 5
b) A factory takes a steady load of 200 kW at a lagging power factor of 0.8. The tariff is Rs. 100 per kVA of maximum demand per annum plus 5 paise per kWh. The phase advancing plant costs Rs. 500 per kVAR and the annual interest and depreciation together amount to 10%.

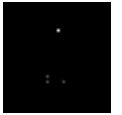
Find :

- i) The value to which the power factor be improved so that annual expenditure is minimum.
- ii) The capacity of phase advancing plant.
- iii) The new bill for energy, assuming that the factory works for 5000 hours per annum.

2 + 2 + 3

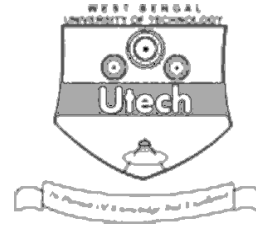


8. A power station has an installed capacity of 210 MW. The capital cost of station is Rs. 1000/MW. The fixed cost is 13% of the cost of investment. On full load at 100% load factor the variable cost of the station per year is 1.3 times the fixed cost. Assume no. reserve capacity and variable cost to be proportional to the energy produced, find the cost of generation per kWh at load factor of 100% and 50%. Comment on the result with the reduction of load factor. 15
9. a) Formulate the problem of optimal hydro-thermal scheduling with its various constraints. 8
- b) Suggest a technique for the solution of the problem. 7
10. a) Discuss the effects of "Load factor" and "Diversity factor" on Power Generation Economics. 2 + 2
- b) What is a "Load curve" ? How does it differ from "Load duration curve" ? 2 + 2
- c) A power station has to meet the following demand :
- Group A : 300 kW between 8 am and 6 pm
- Group B : 200 kW between 6 am and 10 am
- Group C : 50 kW between 6 am and 6 pm
- Group D : 200 kW between 10 am and 6 pm and between 6 pm and 6 am
- Plot the daily load curve and determine
- i) Diversity factor
- ii) Units generated per day
- iii) Load factor. 2 + 2 + 2 + 1



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

- a) Spinning reserve
- b) Reactive power optimization
- c) Cross subsidization
- d) Economic load dispatch.



END