Total No. of printed pages = 4

EE 131702 NR

Roll No. of candidate

23/12/22 2021

B.Tech. 7th Semester End-Term Examination

EE + EEE

POWER SYSTEM OPERATION AND CONTROL

(New Regulation)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Select the correct option : $(10 \times 1 = 10)$

(i) Run-off hydro plant is an example of

(a) Base load plant

(b) Peak load plant

(c) Both (a) and (b)

(d) None of the above

(ii) A synchronous capacitor can supply

(a) Lagging VARs only

(b) Leading VARs only

(c) Both lagging and leading VARs

(d) Neither Lagging nor Leading VARs

(iii) The long term load forecast is needed for

(a) Operation of the plant

(b) Planning the addition in generation capacity

(c) Planning the addition in generation capacity as well as operation of the plant

(d) Economic operation of the plant

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(iv) To make the frequency error zero,

(a) Only Primary ALFC loop is used

(b) Only Secondary ALFC loop is used

(c) Both Primary and Secondary ALFC loops are used.

(d) AVR loop is used

(v) For economic loading of thermal units:

(a) Maintenance cost of units should be minimum

(b) Installation cost of units should be minimum

(c) Incremental costs should be equal

(d) All of the above

(vi) If a generating unit is situated very close to load centre, its penalty factor will be

(a) About 1

(b) Zero

(c) Infinity

(d) Negative

(vii) In a power system

(a) The action of p-f loop is faster than that of Q-V loop

(b) The action of p-f loop is slower than that of Q-V loop

(c) The speed of response of both Q-V and p-f loops is almost the same.

(d) The action of p-f loop may be faster or slower than that of Q-V loop.

(viii) The units of speed regulation of governor are

(a) Hz

(b) Hz per MVA

(c) Hz per MW

(d) None of the above

(ix) At times of low loads, a power system needs

(a) Shunt capacitor

(b) Synchronous condenser

(c) Shunt reactors

(d) All of above

(x) Regulating transformer is used in power system to control

(a) Frequency

(b) Voltage

(c) Real power

(d) Both real and reactive power.

2. (a) How are the turbo-generators loaded for economic operation of power system? Explain the methods. (5)

(b) For a simple two unit system, the loss coefficients are as follows.

B_{11}=0.0010 MW-1

B_{12}= - 0.0005 MW-1

B_{11}=0.0020 MW-1

The incremental cost function for the two units are

IC_1= 0.1P_1+18 Rs./hr.

IC_2= 0.8P_2+14 Rs./hr.

Find the contribution from two units for λ=20. Also, calculate the transmission loss and received power. (5)

(c) Discuss the lambda iterative method to solve economic load dispatch problem. (5)

3. (a) What do you understand by hydro-thermal coordination? Why is it required? (2+3=5)

(b) What is unit commitment? How does it differ from economic load dispatch problem? (2+3=5)

(c) A system consists of two plants connected by a tie line and load is located at plant 2. When 100MW is transmitted from plant 1, a loss of 100MW takes place on the tie line. Determine the generation schedule for both the plants and power received by the load when λ for the system is 25 Rs./MWh and the incremental cost for the units are expressed as

C_1 = 0.03P_1 + 17 Rs/Mwh

C_2 = 0.06P_2 + 19 Rs/ Mwh (5)

4. (a) Explain how real and reactive power can be controlled in a generating system.

(b) Draw the block diagram representation of a single area. What is the role of a governor here?

(c) A control area has a total rated capacity of 10000 MW. The regulation R for all the units in the area is 2 Hz/pu MW. 1% Change in frequency causes 1% change in load. If the system is operating at half of the rated capacity and load is increased by 2%, find the static frequency drop. If the governor loop were kept opened, what would be the value of steady state frequency?

5. (a) What is primary ALFC loop? How does it differ from secondary ALFC loop? (5)

(b) Explain the working of the automatic voltage regulation (AVR) loop. (5)

(c) Two areas are connected by a tie line with following characteristics:

Area-1	Area-2
R=0.01 pu	R = 0.02 pu
D=0.8 pu	D=1.0 pu
Base MVA = 500	Base MVA = 500

A load change of 100 MW occurs in area-1. What is the new steady state frequency what is the change in tie line flow. Assume both areas were at nominal frequency (50HZ) to begin. (5)

6. (a) A 3 phase long line has constant A= 0.98 $\angle 3°$ and B= 110 $\angle 75°$ ohm per phase. If the load is 50 MVA, 0.8 power factor lagging, find the capacity of shunt compensating equipment if

(i) Voltages at the two ends of the line are 132 KV each.

(ii) The voltages at the two ends are to be maintained at 132 KV under no load condition. (5)

(b) Compare integrated power system with unintegrated power systems. (5)

(c) Two identical machines 1 and 2 have droop characteristics with 5% and 2% speed regulation, respectively. They share an initial load of 100MW equally, operating at nominal frequency. If now there is an increase of 40MW in the load, how would the additional load be shared? (5)

7. (a) What is state estimation? Explain a method of state estimation briefly. (2+5=7)

(b) What is a membership function in fuzzy logic? Explain with example. (4)

(c) Explain any method of defuzzification. (4)