Reg. No. : .....

Name : .....

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Sixth Semester B.Tech. Degree Examination, January 2020

(2013 Scheme)

13.605 POWER SYSTEM ANALYSIS AND STABILITY (E)

Time : 3 Hours Max. Marks : 100

PART – A

*Answer **all** questions*

1. Mention any two merits of using Per Unit System for calculations.
2. Enlist the different types of faults in power systems.
3. Establish that symmetrical component transformation is power invariant.
4. What are the different methods used for formation of admittance matrix?
5. Enumerate the assumptions made while conducting load flow using fast decoupled method.
6. In a two plant system, the load is connected to plant no. 2. Which all loss coefficients are zero? Why?
7. What are the thermal unit constraints to be considered during Unit Commitment?
8. Plot the steady state load-frequency characteristics of a speed governor system. Define regulation coefficient.
9. Define transient stability.
10. Derive from first principles the expression for inertia constant.

(10 × 2 = 20 Marks)

P.T.O.

PART – B

Answer any ***one*** *questions from* ***each*** *module*

Module – I

11. (a) Derive the current equations and draw the sequence network for a LG fault (8)

(b) A generator-transformer unit is connected to a line through a circuit-breaker. The unit rating are:

Generator: 10 MVA, 6.6 kV, X_d''=0.1 p.u., X_d'= 0.2 p.u. and Xd=0.8 p.u.

Transformer: 10 MVA, 6.9/33 kV, reactance 0.08 p.u.

The system is operating on no-load at a line voltage of 30 kV, when three phase fault occurs on the line just beyond the circuit breaker, Find

(i) The initial symmetrical r.m.s. current in the breaker.

(ii) The maximum possible DC offset current in the breaker.

(iii) The momentary current rating of the breaker.

(iv) The current to be interrupted by the breaker and the interrupting kVA.

(v) The sustained short-circuit current in the breaker. (12)

12. (a) What do you understand by a short circuit? Discuss the various methods of connecting short-circuit current limiting reactors in the power system. (8)

(b) The voltages at the terminals of a balanced load consisting of three 20 ohm Y-connected resistors are 200<0°, 100 <255.5° and 200 <151° V. Find the line currents from the symmetrical components of the line voltages, if the neutral of the load is isolated. What relation exists between the symmetrical components of the line and phase voltages? Find the power expended in three 20 ohm resistors from the symmetrical components of currents and voltages (12)

Module – II

13. (a) Formulate the load flow problem. Categorize the various buses in a power system and brief upon their characteristics. (10)

(b) Explain the step-by - step algorithm for solving the load flow problem using Newton-Raphson method. (10)

14. (a) Provide the flow-chart for solving load flow with Gauss-Siedel method. (10)

(b) What is meant by DC load flow? Explain the concept of DC load flow. (10)

Module – III

15. (a) Formulate the economic dispatch problem considering the transmission losses and derive the expression for penalty factor. (8)

(b) The incremental cost characteristics of two thermal power plants are given by $\frac{dc_1}{dp_{G1}} = 0.2P_{G1} + 60 \ Rs./MWh \ \frac{dc_2}{dp_{G1}} = 0.3P_{G2} + 40 \, Rs./MWh.$

Calculate the sharing of a load of 200 MW for most economic operation. If the plants are rated 150 MW and 250 MW, respectively, what will be the saving in cost in Rs./hr in comparison to the loading in the same proportion to rating. (12)

16. (a) State the Unit Commitment problem. Elaborate on the various constraints of the problem. (8)

(b) Two units each of 200 MW in a thermal power station are operating all the time throughout the year. The maximum and minimum load on each unit is 200 MW and 50 MW respectively. The incremental fuel characteristics of two thermal power plants are given by $\frac{dc_1}{dp_{G1}} = 0.08p_{G1} + 15 \, Rs./MWh$

$\frac{dc_2}{dp^{G1}} = 0.1P_{G2} + 13 \ Rs./MWh.$ If the total load varies between 100 and 400 MW. Tabulate the allocation of load between two units for minimum fuel cost for various total loads. (12)

Module – IV

17. (a) Develop the block diagram of Load Frequency Control of a single area system. (10)

    (b) What is meant by equal area criterion? How is it applied to analyze the transient stability of a system? (10)

18. (a) Find the steady state power limit of a system consisting of a generator equivalent reactance 0.5 p.u. connected to an infinite bus through a series reactance of 1.0 p.u. The terminal voltage of the generator is held at 1.2 p.u. and the voltage of infinite bus is 1.0 p.u. (12)

    (b) Derive from first principles, the Swing equation of an alternator. (8)

(4 × 20 = 80 Marks)