Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 170807 Date: 28/12/2012

Subject Name: Power System Analysis (Dept. Elective-I)

Time: 10.30 am - 01.00 pm Total Marks: 70

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) A 100 MVA, 33 kV 3-phase generator has a subtransient reactance of 15%. The generator is connected to the motors through a transmission line and transformers as shown in fig.1 The motors have rated inputs of 30 MVA, 20 MVA and 50 MVA at 30 kV with 20% subtransient reactance. The 3-phase transformers are rated at 110MVA, 32 kV Delta/110 kV star with leakage reactance 8%. The line has a reactance of 50 ohms. Selecting the generator rating as the base quantities in the generator circuit, determine the base quantities in other parts of the system and evaluate the corresponding p.u. values. Also draw the reactance diagram. **07**

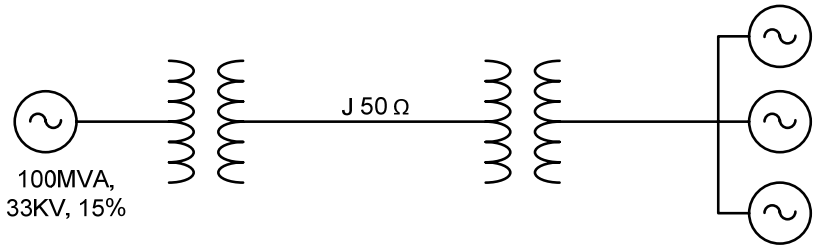

Fig.1

Q.1 (b) (i) What do you mean by infinite bus? **01**

(ii) What is meant by synchronising of alternators? **02**

(iii) What is the effect of increasing the torque of prime mover of one of the two alternators operating in parallel? **02**

(iv) What is the effect of change in speed of one of the two alternators operating in parallel? **02**

Q.2 (a) What is economics dispatch? Derive condition for economics dispatch when generating stations are connected in parallel. **07**

Q.2 (b) What is the significance of load flow in power system? Give classification of various types of buses in a power system for load flow studies. Justify the classification. **07**

OR

Q.2 (b) Fig.2 shows the single-line diagram of a simple four-bus system.Table.1 gives the line impedances identified by the buses on which these terminate. The shunt admittance at all the buses is assumed negligible. Calculate Y_{BUS}. **07**

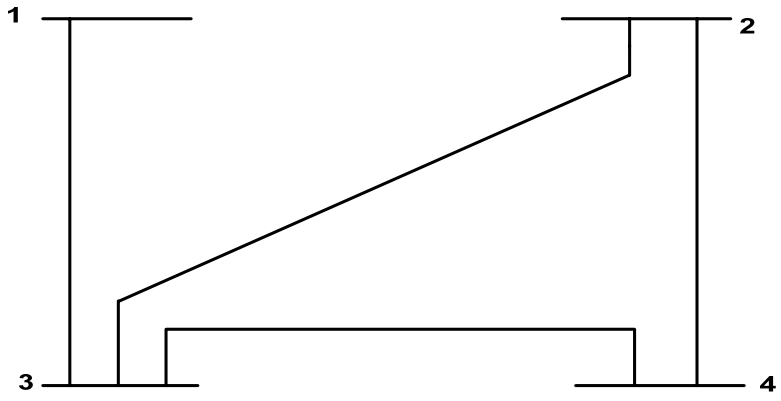

Fig. 2

Line Connecting bus to bus	R pu	X pu
1-3	0.10	0.30
2-3	0.15	0.45
2-4	0.10	0.30
3-4	0.05	0.15

Q.3 (a) Explain double line-to-ground fault. Write terminal conditions at fault location. Derive expression of fault current and draw the connection of sequence networks. **07**

Q.3 (b) Two 11kv, 20 MVA, three-phase, star connected generators operate in parallel as shown in fig.3; the positive, negative and zero sequence reactance of each being, respectively, j0.18, j0.15, j0.10 pu. The star point of one of the generators is isolated and that of other is earthed through a 2.0 ohm resistor. A single line-to-ground fault occurs at the terminals of one of the generator. Estimate (i) the fault current, (ii) current in grounding resistor, and (iii) the voltages across grounding resistor. **07**

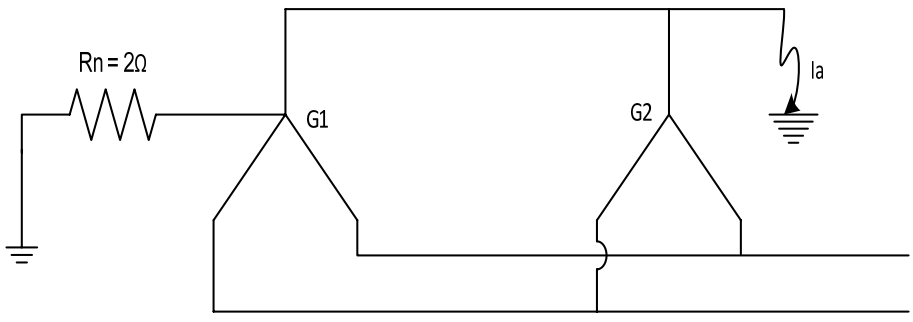

Fig.3

OR

Q.3 (a) Explain line-to-ground fault. Write terminal conditions at fault location. Derive expression of fault current and draw the connection of sequence networks. **07**

Q.3 (b) A 25 MVA, 13.2kV alternator with solidly grounded neutral has a subtransient reactance of 0.25p.u. The negative and zero sequence reactances are 0.35 and 0.1 pu. respectively. Determine the fault current and the line-to-line voltages at **07**

the fault location, when a line-to-line fault occurs at the terminals of an unloaded alternator. Neglect resistance.

Q.4 (a) Explain Z_{BUS} formulation using current injection technique. **07**

Q.4 (b) The line currents in amperes in phases a, b and c respectively are 500+j150, 100-j600 and -300+j600 referred to the same reference vector. Find component of currents. **07**

OR

Q.4 (a) Discuss the short circuit algorithm for large system. **07**

Q.4 (b) The line-to-ground voltages on the high voltage side of a step-up transformer are 100 kV, 33kV and 38 kV on phase a, b and c respectively. The voltage of phase a leads that of phase b by 100^o and lags that of phase c by 176.5^o. Determine analytically the symmetrical components of voltage. **07**

Q.5 (a) (1) Define following **04**

(i) Steady-state stability

(ii) Transient stability

(2) Discuss: Why transient stability limit is lower than steady state stability limit? **03**

Q.5 (b) Given the system of fig.4 where a three-phase fault is applied at the point P as shown. **07**

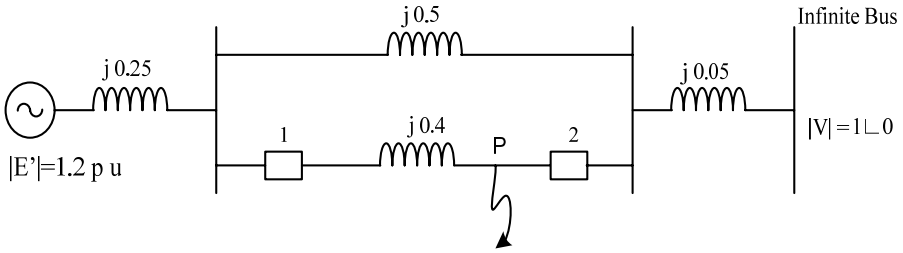

Fig. 4

Find the critical clearing angle for clearing the fault with simultaneous opening of breaker 1 and 2.The reactance values of various components are indicated on diagram. The generator is delivering 1.0.pu power at the instant preceding the fault.

OR

Q.5 (a) Explain the concept of equal area criterion. How can it be used to study transient stability? **07**

Q.5 (b) Find the steady state power limit of a system consisting of a generator equivalent reactance 0.50 pu connected to an infinite bus through a series reactance of 1 pu. The terminal voltage of the generator is held at 1.20 pu and voltage of the infinite bus is 1.0 pu. **07**

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