Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. Sem. - V - Examination – June- 2011

Subject code: 150801

Subject Name: Electrical Power Engineering

Date:24/06/2011 **Time: 10:30 am – 01:00 pm**

Instructions:

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

Q.1 **(a)** Advantages of per unit system. **05**

(b) Explain critical disruptive voltage. **02**

(c) Derive the relation between Symmetrical component & original Phaser. **07**

Q.2 **(a)** Explain the phenomenon of status of current when short circuit occurs on transmission line. **05**

(b) Short note on Selection of circuit breaker. **04**

(c) A 3-phase, 50-hz overhead transmission line 100 km long has the following constants : **05**

Resistance/km/phase = 0.1ohm
Inductive reactance/km/phase =0.2ohm
Capacitive susceptance/km/phase =0.04 x e-4 siemen
Determine (i) the sending end current (ii) sending end voltage (iii) sending end power factor and (iv) transmission efficiency when supplying a balance load of 10,000 kW at 66 kV, *p.f.* 0.8 lagging. Use nominal T method

OR

(c) Explain underground system **05**

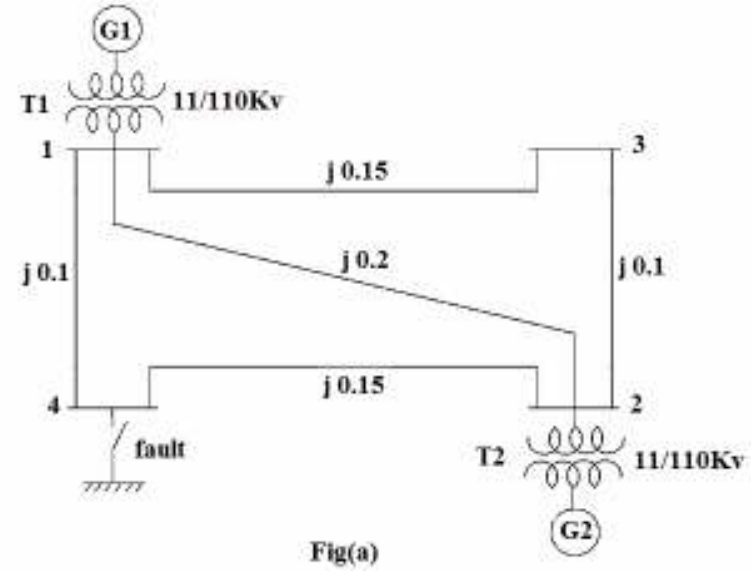
Q.3 **(a)** State the types of unsymmetrical fault analysis & explain any one in detail **06**

(b) Disadvantages of corona **04**

(c) Explain positive sequence impedance and network of synchronous machine. **04**

OR

Q.3 **(a)** Consider the 4-bus system of fig (a). **07**



Fig(a)

buses 1 and 2 are generator buses and 3 and 4 are load buses. The generator are rated 11 kV, 100 MVA with transient reactance of 10% each. Both the transformers are 11/110 kV, 100 MVA with a leakage reactance of 5%. The reactance of the lines to a base of 100 MVA, 110kV are indicated on the figure. Obtain the short circuit solution for a three phase solid fault on bus 4 (load bus).
Assume prefault voltages to be 1 pu and prefault current to be zero.

(b) A 25 MVA, 11 kV, three phase generator has a subtransient reactance of 20%. The generator supplies two motors over a transmission line with transformer at both ends shown in figure (b). The motors have rated input of 15and 7.5 MVA, both 10kV with 25% sub transient reactance. The three phase transforms are both rated 30 MVA, 10.8/121 kV, connection delta-star with leakage reactance of 10% each. The series reactance of line is 100 ohms. Draw the positive & negative sequence network of the system with reactance marked in per unit. **07**
Assume that the negative sequence reactance of each machine is equal to its subtransient reactance. Omit resistance. Select generator rating as base in the generator circuit

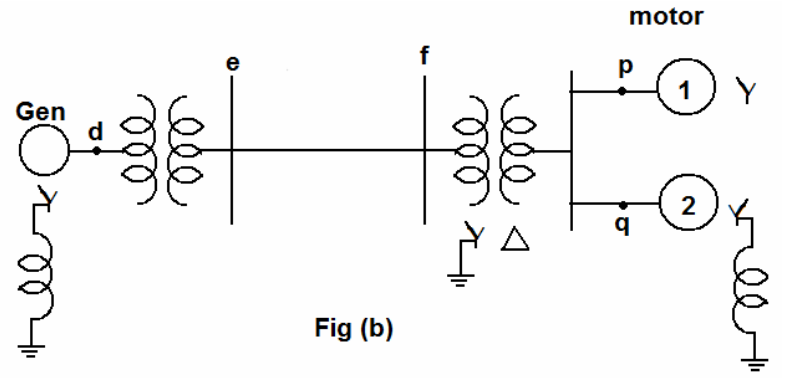


Fig (b)

Q.4 **(a)** Explain capacitance switching. **05**
(b) Short note on synchronous generator **05**
(c) Phase shift in star-delta transformer **04**

OR

Q.4 **(a)** Obtain the per unit impedance diagram of the power system of figure (c).

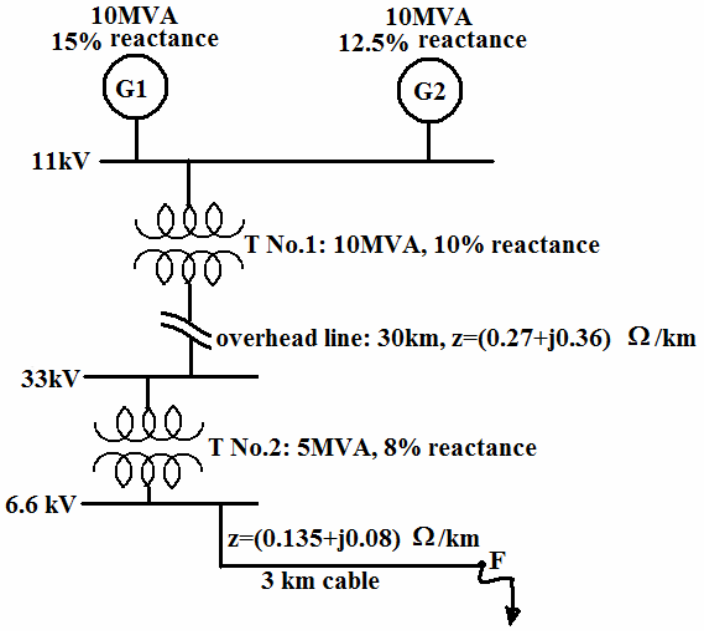


Fig (c)

Generator No.1 : 30 MVA, 10.5 kV, x"=1.6ohms
Generator No.2 : 15 MVA, 6.6 kV, x" =1.2ohms
Generator No.3 : 25 MVA, 6.6 kV, x" = 0.56 ohms

Transformer T_1 (3-phase): 15 MVA, 33/11 kV, x = 15.2 ohms per phase on high tension side. **04**
Transformer T_2 (3-phase): 15 MVA, 33/16.2 kV, x=16 ohms per phase on high tension side.
Transmission line : 20.5 ohms/phase

Load A : 15 MW, 11 kV, 0.9 lagging power factor.
Load B : 40 MW, 6.6 kV, 0.85 lagging power factor.

(b) **05**

For the radial network shown in fig (d). a three-phase fault occurs at F. determine the fault current and the line voltage at 11 kV bus under fault conditions.

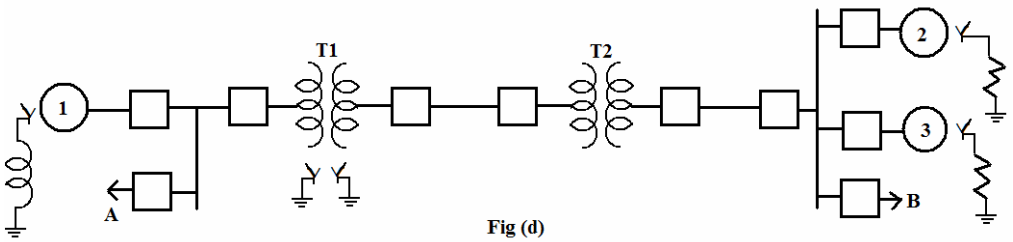


Fig (d)

(c) A single phase overhead transmission delivers 1100 kW at 33 kV at 0.8 *p.f.* lagging. The total resistance and inductive reactance of the line are 10 ohms and 15ohms respectively. Determine : (i) sending end voltage (ii) sending end power factor and (iii) transmission efficiency **05**

Q.5 **(a)** What is medium transmission line? Explain nominal π method of it. **06**
(b) Explain zero sequence network of transformer **06**
(c) What is per unit system? **02**

OR

Q.5 **(a)** Explain the bus impedance matrix method for analysis of unsymmetrical shunt faults. **07**
(b) A 100-km long, 3-phase,50-Hz transmission line has following line constants : **07**
Resistance/phase/km = 0.1 ohm
Reactance/phase/km = 0.5 ohm
Susceptance/phase/km = 10 x e-6 S
If the line supplies load of 20 MW at 0.9 *p.f.* lagging at 66 kV at the receiving end, calculate by nominal π method :
(i) Sending end power factor (ii) regulation (iii) transmission efficiency.

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