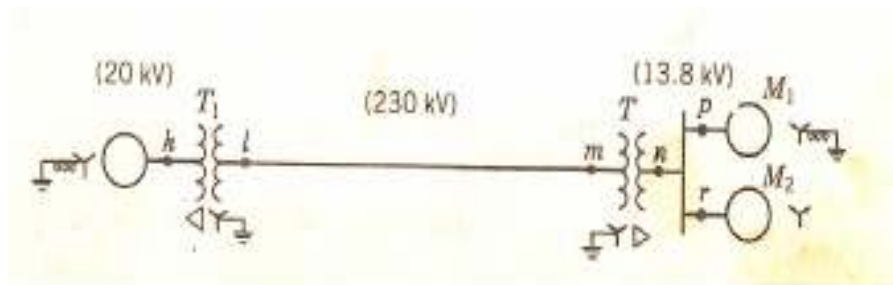


GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-V Examination-Nov/Dec.-2011

Subject code: 150902**Date: 24/11/2011****Subject Name: Power system analysis and simulation****Time: 2.30 pm -5.00 pm****Total marks: 70****Instructions:**

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

- Q.1 (a)** Derive the ABCD constants for medium transmission line using Nominal Π representation. Also write the expressions for voltage regulation and efficiency for the same line. **08**
- (b)** Derive the expression for real power P_R and reactive power Q_R at receiving end of a medium transmission line in terms of transmission line constants (ABCD Constants) **06**
- Q.2 (a)** Explain the Equivalent Circuit model of Synchronous machine. From the first principal, derive $V_t = E_f - I_a (R_a + jX_s)$ Where $X_s = X_{ar} + X_l$. Also draw the equivalent circuit diagram. **07**
- (b)** With the help of neat phasor diagram, explain the operation of synchronous generator for different field excitation. **07**
- OR**
- (b)** The three phase ratings of a three winding transformer are: **07**
Primary Y Connected, 66 KV, 15 MVA,
Secondary Y Connected, 13.2 KV, 10 MVA,
Tertiary Δ Connected, 2.3 KV, 5 MVA,
Neglecting resistance, the leakage impedances are
 $Z_{ps} = 7\%$ on 15 MVA 66 KV Base, $Z_{pt} = 9\%$ on 15 MVA 66 KV Base,
 $Z_{st} = 10\%$ on 10 MVA 13.2 KV Base
Find the per unit impedances of the star connected equivalent circuit for a base of 15 MVA, 66 KV in the primary circuit. Also derive the expressions you use.
- Q.3 (a)** What is P. U. system? Explain the advantages of P. U. System. **06**
- (b)** A 300 MVA 20 KV 3 Φ generator has a subtransient reactance of 20 %. **08**
The generator supplies a number of synchronous motors over a 64 km transmission line having transformers at both ends, as shown in fig. The motors, all rated 13.2 KV are represented by just two equivalent motors. The neutral of one motor M_1 is grounded through reactance. The neutral of the second motor M_2 is not grounded. Rated inputs to the motors are 200 MVA and 100MVA for M_1 and M_2 respectively. For both motors $X'' = 20\%$. The three phase transformer T_1 is rated 350MVA, 230/20 KV with leakage reactance of 10%. Transformer T_2 is composed of three single phase transformers each rated 127/13.2kv, 100 MVA with leakage reactance of 10%. Series reactance of the transmission line is 0.5 Ω /km Draw the reactance diagram with all the reactances marked in per unit. Select the generator rating as base in the generator circuit.

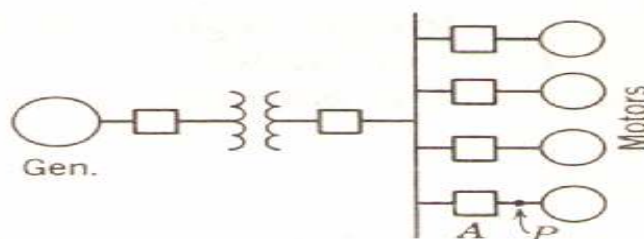


OR

- Q.3 (a)** What is characteristic impedance? Derive the expressions of V_R and I_R at any point of line as a function of distance X from the receiving end using distributed parameters. **07**
- (b)** A single circuit 60 Hz transmission line is 370 km long. The load on the line is 125 MW at 215 kV with 100% power factor. Find the voltage, current and power at sending end and voltage regulation of the line. (Given $z=0.5239 \angle 79.02^\circ \Omega/\text{km}$ and $y=3.17 \times 10^{-6} \angle 90^\circ \text{ mho/km}$) **07**
- Q.4 (a)** Derive the expressions of positive, negative and zero sequence voltage components in terms of given set of unbalance voltage phasors V_a , V_b and V_c . Also prove that the transformation used is power invariant. **08**
- (b)** One conductor of a three phase line is open. The current flowing to the Δ Connected load through line "a" is 10 A. with the current in line "a" as reference and assuming that line "c" is open, find the symmetrical components of the line currents. **06**

OR

- Q.4 (a)** Explain traveling and reflecting waves on transmission line with open end at the receiving . **07**
- (b)** A 25 MVA 13.8 KV generator with $X_d'' = 15\%$ is connected through a transformer to a bus which supplies four identical motors as shown in Fig. The subtransient reactance X_d' of each motor is 20% on a base of 5MVA, 6.9 KV. The three phase rating of the transformer is 25 MVA 13.8/6.9 KV with a leakage reactance of 10%. The bus voltage at the motors is 6.9 kv when a three phase fault occurs at the point P. for the fault specified, Determine (a) the subtransient current in the fault, (b) the subtransient current in breaker A. **07**



- Q.5 (a)** Enlist the methods of neutral grounding. Explain any one of the method in detail. **07**
- (b)** Explain the phenomena of arcing grounds. How does neutral grounding eliminate the arcing ground? Also enlist the advantages of neutral grounding. **07**

OR

- Q.5 (a)** Explain the phenomena of corona. Also discuss the measures taken to control corona in EHVAC transmission lines. **07**
- (b)** Explain the phenomena of sudden three phase short circuit at the generator terminal on no load condition and define sub transient, transient and steady state reactances of synchronous generator. **07**
