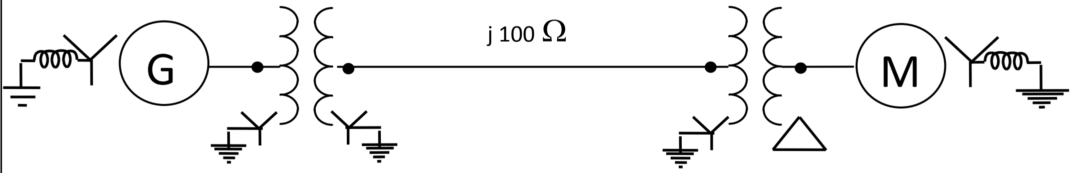
BE Semester- VI (Electrical Engineering) Question Bank

(E 605 ELECTRICAL POWER SYSTEM - II)

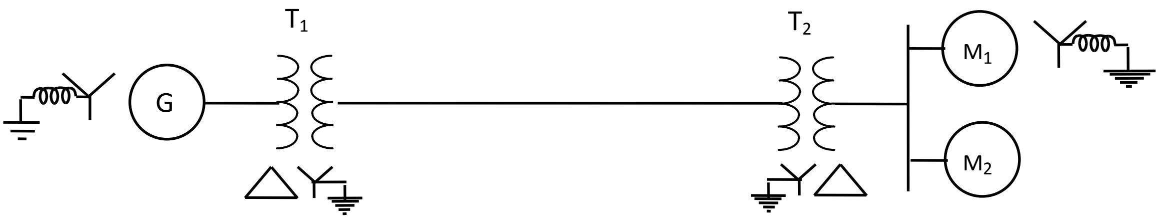
All questions carry equal marks (10 marks)

<table>
<tr><td>Q.1</td><td>Explain per unit system in context with three-phase power system and state advantages and disadvantages of the same.</td></tr>
<tr><td>Q.2</td><td>Draw the per unit impedance diagram for the power system shown below. Neglect resistance and use a base of 50 MVA, 220 kV in 100 Ω line. The rating of generator, transformers and motor are

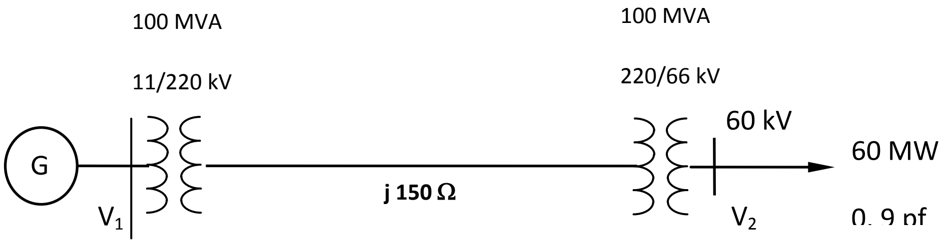
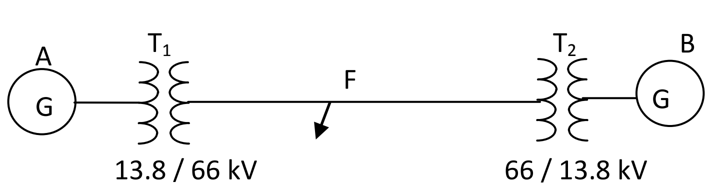
Generator : 500 MVA, 25 kV, X" = 20 %
Motor : 200 MVA, 11 kV, X" = 30 %
Y - Y transformer : 300 MVA, 33Y / 220Y kV, X = 15 %
Y - Δ transformer : 300 MVA, 11Δ / 220Y kV, X = 15 %

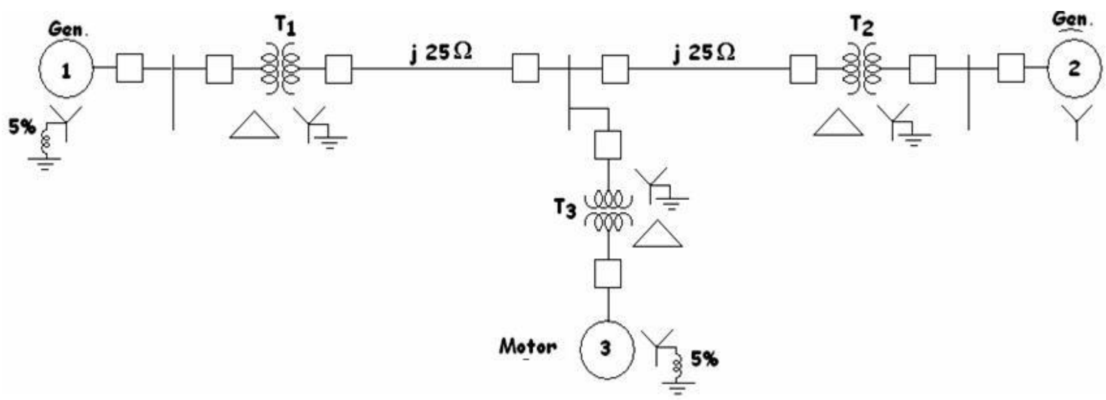


</td></tr>
<tr><td>Q.3</td><td>Figure given below shows a generator feeding two motors through transformers and line. The ratings and reactances are as under.
Generator : 100 MVA, 11 kV, X = 25 %
Transformer T_1 : 110 MVA, 10 / 132 kV, X = 6 %
Transformer T_2 : Bank of three single phase transformers each rated at 30 MVA, 66 kV / 10 kV, X = 5 %
Motor M_1 : 40 MVA, 10 kV, X = 20 %
Motor M_2 : 50 MVA, 10 kV, X = 20 %
Transmission line: X = 100 Ω
Select generator rating as base values, draw reactance diagram and indicate per unit reactances on the diagram.



</td></tr>
<tr><td>Q.4</td><td>Figure given below shows the schematic diagram of a radial transmission system. The ratings and reactances of the various components are shown therein. A load of 60 MW at 0.9 power factor lagging is tapped from the 66 kV substation which is to be maintained at 60 kV. Calculate the terminal voltage of the synchronous machine. Represent the transmission line and the transformers by series reactances only.</td></tr>
</table>

	
Q.5	For 3 phase overhead transmission line the generalized circuit constants are as follows: $A=D= 0.9\angle 2°$, $B=140\angle 70°$ ohm/phase. Line delivers 60 MVA at 132 kV and at 0.8 p.f. lag. Construct the circle diagrams and find (a) Sending end voltage (b) Power angle (c) The maximum power that the line can deliver (d) Sending end power (e) Sending end power factor
Q.6	A 3 phase, 50 Hz transmission line having following data $A=D= 0.8616\angle 4°12'$, $B=196.5\angle 77°18'$, ohm $C=0.0014298\angle 90°18'$ mho supplies a load of 40000 kW at 0.8 p.f. lagging at 132 kV (receiving end). Draw a universal power circle diagram for this line and find there from (a) sending end voltage (b) sending end current (c) sending end power factor (d) efficiency under these conditions
Q.7	Discuss considerations for selection of circuit breakers in context with power system fault analysis.
Q.8	Discuss the variation in reactance of synchronous generator delivering no-load when a three-phase dead short circuit takes place on its terminals with necessary diagrams.
Q.9	As shown below generators A and B are identical and rated 13.8 kV, 21000 kVA and have a transient reactance of 30% at own kVA base. Transformers are also identical and are rated 13.8/66 kV, 7000 kVA and have a reactance of 8.4% to their own kVA base. The tie line is 50 miles long; each conductor has a reactance of 0.848 Ω per mile. Three-phase fault is assumed at F, 20 miles from generator A. Find the current in the short circuit. 
Q.10	A generator is connected to a synchronous motor through a transformer. To common MAVA base and kV base, pu subtranseint reactance of the generator and motor are 0.15 and 0.35 respectively. The leakage reactance of the transformer being 0.10 pu, three-phase fault occurs at the terminals of the motor when the terminal voltage of the generator is 0.9 pu and the output current of the generator is 1.0 pu at 0.8 power factor load. Find the subtranseint

	currents in pu in the fault in (i) generator (ii) motor.
Q.11	Discuss bus impedance method for symmetrical short circuit analysis in details.
Q.12	Explain application of Thevenin's theorem with an example for symmetrical fault analysis.
Q.13	Explain symmetrical components technique for solving three-phase unbalanced system and derive an expression for complex 3-pahse power in terms of symmetrical components of voltages and currents.
Q.14	In a delta connected load, the current flowing in the line A is 100 A while the line C is open. With the current in line A as reference, calculate the currents in all the lines and their symmetrical components.
Q.15	The currents flowing in the lines of a balanced load connected in delta are: $I_a = 10\angle 0° A, I_b = 14.14\angle 255° A, I_c = 10\angle 90° A$ Show that $$I_{ab_1} = \frac{I_{a_1}}{\sqrt{3}}\angle 0° \text{ and } I_{ab_2} = \frac{I_{a_2}}{\sqrt{3}}\angle -30°$$
Q.16	A balanced star connected load takes 90 A from a balanced 3-phase, 4-wire supply. If the fuses in the Y and B phases are removed, find the symmetrical components of the line currents (i) before the fuses are removed (ii) after the fuses are removed.
Q.17	Develop zero sequence network for the power system shown below:  Ratings of components of above diagram are as follows: Gen 1 : 25MVA, 11kV, X1 = 0.2, X2 = 0.15, X0 = 0.03 pu Gen 2 : 15MVA, 11kV, X1 = 0.2, X2 = 0.15, X0 = 0.05 pu Syn. Motor 3 : 25MVA, 11kV, X1 = 0.2, X2 = 0.2, X0 = 0.1 pu Transformer T1: 25MVA, 11 Δ / 120 Y kV, X = 10% Transformer T2: 12.5MVA, 11 Y/ 120 Δ kV, X = 10% Transformer T3: 10MVA, 120 Y/ 11 Δ kV, X = 10% Choose a base of 50MVA, 11 kV in the circuit of generator. Note: Zero sequence reactance of each line is 250% of its positive sequence reactance.
Q.18	Explain construction of sequence network for synchronous generator and three-phase two-

	winding transformer.
Q.19	Answer the following: (i) In case of alternator, a single line L-G fault is more sever than an L-L-L fault when it occurs at the terminals. (ii) Why are positive and negative sequence equivalents circuits not affected by the method of neutral grounding?
Q.20	A generator with grounded neutral has sequence impedances of Z_1, Z_2 and Z_0 and generator emf E. If a single line to ground fault occurs on the terminal of phase 'a', find the expressions for fault current and voltages V_b & V_c. Assume $Z^f = 0$. Also show the interconnection of sequence networks under the given fault condition.
Q.21	A 25 MVA 13.2 kV, alternator with solidly grounded neutral has sub transient reactance of 0.25 pu. The negative and zero sequence reactances are 0.35 and 0.1 pu respectively. A single line to ground fault occurs at the terminals of an unloaded alternator. Determine the fault current and line to line voltage.
Q.22	A generator with grounded neutral has sequence impedances of Z_1, Z_2 and Z_0 and generator emf E. If a line to line fault occurs on the terminal of between phases 'b' and 'c', derive expressions for fault current and construct interconnection of sequence networks.
Q.23	Explain double line to ground fault along with interconnection of sequence network and all necessary expression.
Q.24	A 50 MVA, 11kV 3-phase alternator was subjected to different types of faults. The fault currents are (1) 3- phase fault = 1870A (2) Line – to- line fault = 2590A (3) Single line – to – ground fault = 4130A Alternator neutral is solidly grounded. Find the values of three sequence reactances of the alternators.
Q.25	A 3-phase generator rated 15MVA, 13.2 kV has a solidly grounded neutral. Its positive, negative and zero sequence reactances are 40%, 30% and 5% respectively. (a) Find the value of reactance to be connected in the neutral circuit so that fault current for a single line to ground fault does not exceed rated line current. (b) Find the value of resistance to be connected in the neutral circuit to serve the same purpose.
Q.26	Explain working and application of synchronous condenser in power system for voltage control.
Q.27	What the different methods for voltage control in power system? Explain any one of the methods in details.
Q.28	Explain working and application of booster transformer in power system for voltage control.
Q.29	Explain working and application of tap changing transformer in power system for voltage control.
Q.30	Discuss in details the use of shunt capacitor and shunt reactor for voltage control in power system.
Q.31	What are the different methods for improvement of power factor? State disadvantages of low power factor in power system.
Q.32	Classify various tariffs and explain any two in details.
Q.33	Discuss the choice of size and number of generator units in details.
Q.34	Classify costs in power plant and discuss method of depreciation determination for cost analysis of power plant.
Q.35	Derive an expression of most economical power factor when (i) kW demand is constant and

	(ii) kVA maximum demand is constant.
Q.36	Discuss travelling wave and wave propagation of surges in details.
Q.37	Explain reflection and refraction of travelling waves with necessary diagrams and expressions.
Q.38	Describe Bewley lattice diagram in details.
Q.39	Discuss Wilson’s and Simpson’s theory.
Q.40	Explain arcing ground in details.