[Time: Three Hours]

[Marks:80]

Note:
1. Question No. 1 is compulsory.
2. Attempt any 3 questions from the remaining five questions.
3. Figures to the right indicate full marks.
4. Make suitable assumptions wherever necessary.

I) Answer any Four.   (20)

a) What are bundled conductors? For Extra high voltage (EHV) transmission bundled conductors are used. Justify.

b) Derive the expression for voltage regulation of a short transmission line from its phasor diagram.

c) Pin type insulators are used for low voltage lines while suspension type insulators are used for high voltage lines. Explain.

d) What is per unit system? How base values are selected?

e) What are the capacitances in 3-Φ , 3 core cables. How they can be measured?

II)

a) Fig.1 below shows a power system. The ratings of generators and transformers are as follows: (10)

Generator G_1 :   25 MVA, 6.6 kV, j 0.2 p.u
Generator G_2 :   15 MVA, 6.6 kV, j 0.15 p.u
Generator G_3 :   30 MVA, 13.2 kV, j 0.15 p.u
Transformer T_1 :   30 MVA, 6.6 kVΔ / 115 kV Y, j0.1 p.u
Transformer T_2 :   15 MVA, 6.6 kVΔ / 115 kV Y, j0.1 p.u
Transformer T_3 :   single phase units each rated 10 MVA, 69/6.9 kV, j0.1 p.u

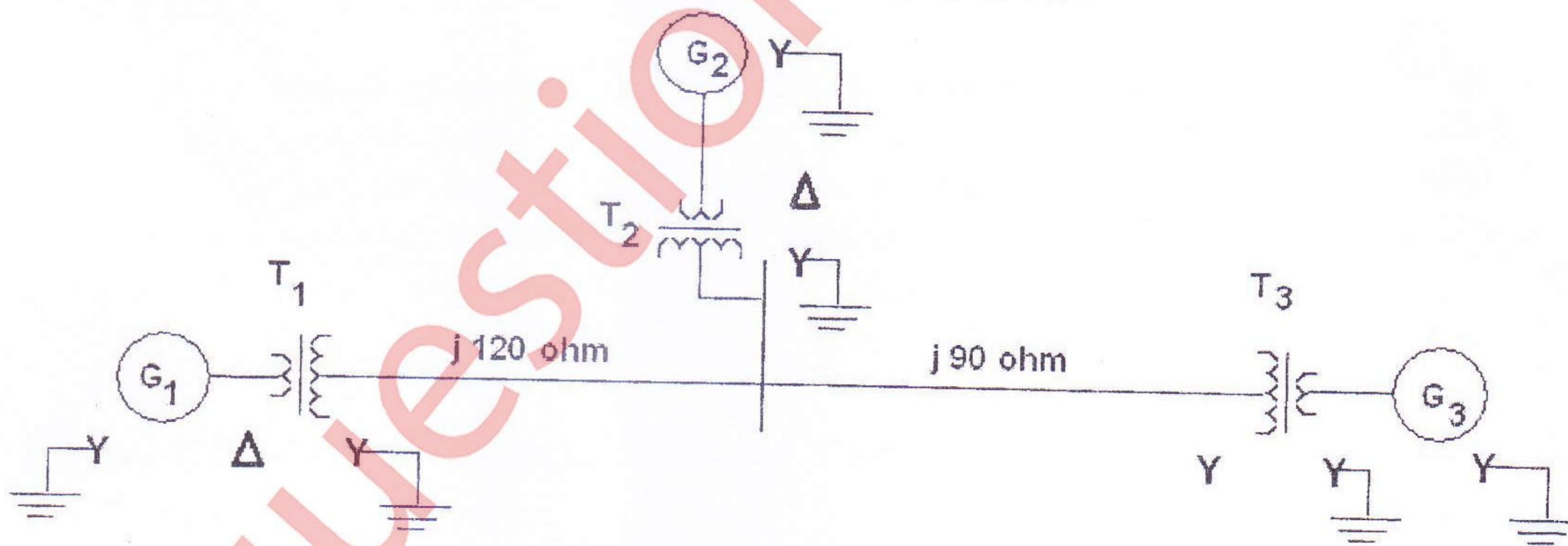Draw the reactance diagram with all values in p.u. on a base of 30 MVA, 6.6 kV in the circuit of Generator G_1

Fig. 1

b) With neat single line diagram explain the general AC power transmission scheme.   (10)

III)

a) Draw the circuit representation and phasor diagram of a medium transmission line in Nominal Π method and also derive the expressions for its A,B,C,D constants.   (10)

b) A 3-Φ, 66 kV, 50 Hz line has a resistance of 9.6 Ω, inductance of 0.097 H and capacitance of 0.765 μF per phase resp.. It delivers 24 MVA at 66 kV at 0.8 pf lagging. Find voltage regulation and transmission efficiency. Use Nominal T circuit.   (10)

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IV)

a) Assuming the shape of an overhead line to be a parabola, derive the expression for calculating sag and conductor length. How can the effect of wind and Ice loadings be taken into account? **(10)**

b) A string insulator has 3 units. The capacitance from each joint to the tower is 12.5 % of the capacitance of each unit. It is desired that the voltage across any unit should not exceed 11 kV. Find the maximum voltage across the string for which it can be used. **(10)**

V)

(a) Derive the expression for inductance per phase of a 3-ø double circuit line with flat vertical spacing. Assume the line is transposed. **(10)**

(b) A 3-Φ, single circuit bundled conductor line with three sub-conductors per phase has horizontal spacing with 6.1 m between the centre lines of adjacent phases. The distance between the sub conductors of each phase is 30.5 cm and each sub-conductor has a diameter of 2.54 cm. Find the inductance and capacitance per phase per km. **(10)**

VI) Answer any two **(20)**

(a) What do you understand by Grading of Cables ? Explain any one method in detail.

(b) What are the different methods of Neutral Grounding? Explain the features of solidly (Effectively) grounded system and Resonant (Arc suppression coil) grounding.

(c) Define earth electrode, earth current , resistance of earth electrode, Tolerable step and touch potential.

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